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ABSTRACT

This curriculum guide is designed to assist junior high school industrial arts teachers in planning new courses and revising existing courses in construction technology. Addressed in the individual units of the guide are the following topics: basic types of construction and the impact of construction on society, preconstruction, personnel management, energy conservation, construction, entrepreneurship, postconstruction, and computer applications in construction. Each unit contains some or all of the following: objectives, key words, a list of teaching aids needed, suggested references, a sentence outline, a list of materials for students, suggested student activities, student worksheets, transparency masters, student handouts, and a unit test. Appendixes to the guide include lists of references, films, and pamphlets; a list of materials and equipment suppliers; and computer programs dealing with converting various units of measurement, performing accounting and financial planning applications, and executing various graphics and conversion problems related to construction. (MN)

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Construction Technology

By

James L. Barnes

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Contents

Foreword / v
Acknowledgments / vi
Notes to the Teacher / viii
Essential Elements / xi
Competencies for Construction / xiii

Unit 1: Introduction / 1

I. Why study construction?
II. The impact of construction on society
III. Three types of construction systems
IV. Construction safety and technology

Unit 2: Preconstruction / 17

I. Introduction
II. Beginning the site
III. Construction drafting and design

Unit 3: Personnel Management / 41

I. Applying for a job
II. Understanding how the construction industry hires, trains, advances, retrains, demotes, and retires workers
III. Careers in the construction industry
IV. Youth leadership

Unit 4: Energy Conservation / 73

I. Different types of alternative energy sources
II. Basic principles of energy conservation
III. Energy conservation for little or no cost
IV. Energy conservation for little or some cost
V. Energy conservation for some cost or large investment which requires economic justification
VI. Energy auditing

Unit 5: Construction / 93

I. Contracting
II. Structures
III. Subcontracting

Unit 6: Entrepreneurship / 111

I. Introduction
II. What is communism?
III. What is socialism?
IV. What is capitalism?
V. The free enterprise system and entrepreneurs
VI. Becoming an entrepreneur
VII. Dangers and pitfalls to avoid
VIII. Guidelines for entrepreneurship
IX. Planning your business

Unit 7: Postconstruction 119

I. Analyzing basic maintenance and repair problems
II. Interior maintenance and repair
III. Exterior maintenance and repair
IV. Electrical maintenance and repair
V. Plumbing maintenance and repair
VI. Altering and remolding

Unit 8: Computer Applications in Construction 133

I. Introduction
II. Construction management applications
III. Computer-aided design (CAD)
IV. Robotics

Appendices / 145

A / References, Films, and Pamphlets
B / List of Materials and Equipment Suppliers
C / Computer Printouts

Foreword

This publication is one of the new series of instructional materials for industrial arts education. It is designed to assist teachers as they plan and implement new courses of study and as they make revisions and improvements in existing courses. This publication is intended to help industrial arts teachers create learning environments that respond to the needs of students growing up in a complex industrial-technical society. It provides a framework that enables teachers to integrate classroom learning with real-life experiences of students.

Industrial arts is being challenged to expand and clarify its function. To meet this challenge, the industrial arts curriculum must provide opportunities for students to learn more about the technological realities in our society. This publication provides teachers with an instructional platform that focuses on industrial art's commitment to establish its content base in the technologies.

Every effort has been made to produce a publication that addresses the unique needs of our current student population. Students with limited English proficiency (LEP) as well as handicapped, educationally disadvantaged, and nontraditional students may require modification of the material in this publication. The professional staff of EIMC will gladly work with any instructor having these students to show how the instructional material can be adapted for specific individualized instruction. Consult local, state, and federal agencies that offer assistance and guidance and that can provide sound recommendations for productive classroom management.

Kathryn R. Allen, Ph.D.
Acting Director, Extension
Instruction and Materials Center

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J. L. B.

Notes to the Teacher

Using the Curriculum Material

Intended Audience. The material in this curriculum package is designed for use by junior high/middle school industrial arts teachers in exploratory/introductory programs.

Length of Time for the Material. The topic of study has been developed to provide enough material for eighteen weeks of study. Individuals who teach six-, nine-, or twelve-week classes can select parts of this curriculum material as the substance of their classes.

Emphasis of the Material. Keep in mind that this curriculum material is exploratory in nature. The emphasis is on exposing students to a wide range of experiences within the topic of study rather than on the development of technical expertise in one area.

Benefits for Teachers and Students. This material is designed to assist industrial arts teachers in the classroom as they reinforce and enhance students' skills in reading, mathematics, communications, problem solving, and social interaction. In addition, teachers who use this curriculum material will be able to help their students gain an understanding of and appreciation for management and work skills needed by individuals in the world of work. The broad exposure students receive in the topic of study will assist them in making meaningful career choices.

Flexibility of the Material. This curriculum material, like any other material, cannot encompass all situations. Therefore, teachers should feel free to supplement the material with other ideas, information, or activities as needed in their particular programs.

This material can be used in a number of different ways by industrial arts teachers. Some teachers may desire to use it as the starting point, a foundation upon which to build their own courses of study. Other teachers may prefer to teach the material as it is and add to it as they feel the need. Still other teachers may pick and choose only selected parts of this curriculum for use in their classes.

Teachers may also need to make substitutions in the curriculum depending on the equipment or references available. Other circumstances may also require teachers to make curriculum substitutions. The flexibility of this material enables teachers to use it in various ways and under various conditions. This curriculum provides teachers with an alternative in course design.

Competencies. Competencies have been identified for the topic of study. As used in this material, competencies represent skills, knowledge, or attitudes that imply the ability or intelligence to accomplish a task or job. They represent the instructional intent and are stated as specific goals to be achieved. Competencies assist teacher and students in clearly formulating a purpose for learning.

Organization of the Curriculum Material

The material in this topic of study is organized into instructional units. The framework used to develop each unit consists of a number of components. These components focus on (1) outcomes, (2) materials, (3) content, (4) activities, and (5) evaluation. The components are further divided and standardized in each topic of study. An explanation of each part in the instructional unit follows.

Objectives. Objectives have been identified for each instructional unit. The objectives reflect the kind of performance necessary to successfully complete a task or job. These objectives enable a student to attain the stated competencies. Furthermore, each unit's objectives are reflected in the content, student activities, and tests for that unit.

Objectives help the teacher and the student to focus upon the important concepts to be learned in each unit. Teachers may want to duplicate the competencies and objectives and give them as handouts to the students.

Key Words: Vocabulary. New words or terms are listed to enable you to help students develop their vocabulary. Some words or terms may be listed in several units because they are used throughout a topic of study. The repetition helps reinforce vocabulary building. A student vocabulary worksheet has been included with each unit.

Teaching Aids. The materials, equipment, and supplies identified in this section will enable the teacher to plan and organize instruction better. Teachers need to review this list of teaching aids before the day of instruction since some substitutions in equipment may be needed under certain conditions. A test key has been included to help the teacher in correcting the unit test.

Each transparency in this unit is also listed and briefly described. Transparency masters are provided at the end of each unit. The transparencies are keyed to a point in the sentence outline where their use is considered most appropriate. In addition to being used as transparencies, the masters may be duplicated and used as student handouts if the teacher so desires. Teachers may design or develop other transparency material that they feel enhances their instruction.

Suggested References. Many of the publications listed are available from textbook publishers. However, the reading level of these textbooks is often above junior high/middle school grade level. The material listed in this section is suggested for use by teachers as a way to supplement their knowledge in the subject area. Teachers can review these references and use selected material as supplements to their lectures and demonstrations when appropriate. Some of the sources suggested offer free or inexpensive materials that teachers may use with their students.

Sentence Outline. The information presented in this section represents the conceptual focus of the unit. The ideas and concepts are presented in a sentence outline, as a guide from which to teach. The outline should serve as a reference from which teachers can provide instruction.

The intent was not to needlessly duplicate material that is readily available to teachers. Rather, the intent was to provide teachers with basic ideas and information that may be less accessible. The suggested references and other resources can be used by teachers to build a knowledge base from which they can synthesize relevant concepts and information. Suggested references can be used to supplement, expand, and clarify learning activities and instruction.

Materials for Students. Suggestions to teachers regarding student materials may also be listed here. Student handout materials, such as exercises, charts, and graphs, are provided at the end of each unit when appropriate. These student handouts immediately follow the suggested student activities section. Handout materials may be reproduced and given to students.

Suggested Student Activities. The suggested activities are designed to reinforce and provide real applications of the concepts and content within each unit. These activities have been designed to use existing facilities and equipment, as much as possible. Another consideration was the cost factor. Suggested activities are designed to require minimum cost.

Each teacher should, therefore, examine the activities and select those which are appropriate for their students. Teachers can change or modify the suggested activities if equipment, materials, and funds are not available. Teachers need to be selective in the activities they use since some activities take longer than others. Some are designed for group activity while others are for individual work. The teacher's content emphasis must also be considered. Each of the activities has been designed to reinforce and enhance basic skills that students need in everyday life.

Tests. Each unit has a multiple-choice test to assist teachers in evaluating student achievement. Multiple-choice tests provide certain advantages for teachers in evaluating the teaching-learning process. They do not capitalize on chance answers to the extent that true-false tests do. Careful development of test answers will help teachers evaluate a student's comprehension of important concepts. This also provides teachers with an easy way to assess the effectiveness of their instruction through item analysis.

Written tests are only one method of assessing learning. Teachers will also need to evaluate a student on actual performance in each activity, on abilities, and on general progress toward reaching objectives. Each teacher should develop an evaluation system that provides the most accurate assessment of a student's progress.

Teachers may prefer to develop their own test instruments. However, their test items should focus upon objectives and course content. The test for each instructional unit in this curriculum material does focus on the objectives stated at the beginning of each unit and on unit content. A test key is also provided in the teaching aids section of each unit for the teacher's use in correcting tests.

Essential Elements

I. Essential Elements Common to All Vocational Education Programs
  A. Leadership concepts and skills
    The student shall be provided opportunities to—
    1. identify characteristics and responsibilities of leaders and effective group members;
    2. participate in orderly meetings conducted according to parliamentary procedure;
    3. function effectively on committees;
    4. plan and conduct leadership activities; and
    5. prepare for effective citizenship and participation in our democratic society.
  B. Concepts and skills related to successful employment
    The student shall be provided opportunities to—
    1. develop an awareness of employment opportunities in a chosen field;
    2. practice correct procedures for job application and interview;
    3. develop the ability to take and follow both oral and written directions;
    4. practice punctuality and dependability;
    5. observe rules and standards of the workplace;
    6. demonstrate an ability to work with others harmoniously;
    7. develop responsibility and the ability to follow through on assigned tasks; and
    8. exhibit productive work habits and attitudes.
  C. Concepts and skills associated with entrepreneurship
    The student shall be provided opportunities to—
    1. recognize opportunities and options for business ownership;
    2. identify entry-level procedures, planning processes, and terms needed to open a business; and
    3. develop an understanding of the role of small business in the free enterprise system.

II. Essential Elements Common to All Industrial Arts Programs
  A. Concepts and skills in the application of safety procedures
    The student shall be provided opportunities to—
    1. demonstrate safe operation and use of selected tools and equipment to avoid injury; and
    2. maintain safe conditions in the laboratory.
  B. Concepts and skills related to planning, designing, and problem solving
    The student shall be provided opportunities to—
    1. plan and design industrial products of the student's choice;
    2. measure accurately using metric and customary units;
    3. complete itemized list of materials; and
    4. make working drawings of projects.
  C. Concepts and skills related to the tools, materials, and process of technology
    The student shall be provided opportunities to—
    1. solve industrial problems by using a variety of industrial materials;
    2. use correctly selected hand and machine tools; and
    3. select the most suitable process to complete a project.
  D. Concepts and skills related to the past, present, and future of technology
    The student shall be provided opportunities to—

    1. recognize ideas and inventions of the past and present; and
    2. relate technological change to the skills needed for the future.
  - E. Concepts and skills related to evaluating products and services of technology
    The student shall be provided opportunities to—
    1. recognize good design and construction;
    2. evaluate products based on given standards or applications;
    3. service industrial products and equipment; and
    4. develop criteria for selecting, purchasing, and contracting services.

III. Concepts and Skills Related to Production Technology
The student shall be provided opportunities to—
- A. apply industrial organization and management systems by planning, organizing, and controlling production processes;
- B. apply primary industrial processes of layout, testing, separating and cutting, drilling and boring, shaping and forming, casting, laminating, coating, decorating, joining, and finishing;
- C. research the recycling of industrial materials;
- D. plan and implement the various steps in the construction process;
- E. research the transformation of raw materials into finished products;
- F. plan and implement mass production activities;
- G. demonstrate techniques and processes used in automated production systems; and
- H. use computers in planning, production, quality control, and management of production systems.

IV. Concepts and Skills Related to Production Technology in the Area of Construction
The student shall be provided opportunities to—
- A. analyze those processes involved in selecting and acquiring a construction site;
- B. design and construct a foundation, floor, wall, ceiling, and roof;
- C. research prefabricated systems;
- D. participate in electrical systems installation activities;
- E. practice simple plumbing techniques;
- F. practice trimming and finishing techniques;
- G. explore remolding procedures;
- H. practice basic masonry techniques;
- I. discuss contracting and subcontracting practices;
- J. develop a basic knowledge of landscaping;
- K. research new construction materials and methods;
- L. explore energy conservation principles involved in construction;
- M. explore techniques and processes used in automated production systems; and
- N. research the recycling of construction materials.

Competencies for Construction

Concepts and skills related to production technology in the area of construction
The student shall be provided opportunities to—

- analyze those processes involved in selecting and acquiring a construction site;
- apply principles involved in designing a simple floor plan;
- design and construct a foundation, floor, wall, ceiling, and roof;
- research prefabricated systems;
- participate in electrical installation activities;
- experiment with simple plumbing and temperature systems;
- practice trimming and finishing procedures;
- discuss contracting and subcontracting practices;
- explore remolding procedures;
- compare manufacturer's service contracts;
- develop a basic knowledge of landscaping;
- research new construction materials and methods;
- explore energy conservation principles involved in construction;
- study future construction techniques and needs;
- develop youth leadership skills;
- participate in entrepreneurship activities; and
- develop employability skills.

COMPLIANCE STATEMENT

TITLE VI, CIVIL RIGHTS ACT OF 1964; THE MODIFIED COURT ORDER, CIVIL ACTION 5281, FEDERAL DISTRICT COURT, EASTERN DISTRICT OF TEXAS, TYLER DIVISION

Reviews of local education agencies pertaining to compliance with Title VI Civil Rights Act of 1964 and with specific requirements of the Modified Court Order, Civil Action No. 5281, Federal District Court, Eastern District of Texas, Tyler Division are conducted periodically by staff representatives of the Texas Education Agency. These reviews cover at least the following policies and practices:

(1) acceptance policies on student transfers from other school districts;

(2) operation of school bus routes or runs on a non-segregated basis;

(3) nondiscrimination in extracurricular activities and the use of school facilities;

(4) nondiscriminatory practices in the hiring, assigning, promoting, paying, demoting, reassigning, or dismissing of faculty and staff members who work with children;

(5) enrollment and assignment of students without discrimination on the basis of race, color, or national origin;

(6) nondiscriminatory practices relating to the use of a student's first language; and

(7) evidence of published procedures for hearing complaints and grievances.

In addition to conducting reviews, the Texas Education Agency staff representatives check complaints of discrimination made by a citizen or citizens residing in a school district where it is alleged discriminatory practices have occurred or are occurring.

Where a violation of Title VI of the Civil Rights Act is found, the findings are reported to the Office for Civil Rights, Department of Health, Education and Welfare.

If there is a direct violation of the Court Order in Civil Action No. 5281 that cannot be cleared through negotiation, the sanctions required by the Court Order are applied.

TITLE VII, CIVIL RIGHTS ACT OF 1964: EXECUTIVE ORDERS 11246 and 11375; TITLE IX 1973 EDUCATION AMENDMENTS: REHABILITATION ACT OF 1973 AS AMENDED; 1974 AMENDMENTS TO THE WAGE-HOUR LAW EXPANDING THE AGE DISCRIMINATION IN EMPLOYMENT ACT OF 1967; VIETNAM ERA VETERANS READJUSTMENT ASSISTANCE ACT OF 1972 AS AMENDED IN 1974.

It is the policy of the Texas Education Agency to comply fully with the nondiscrimination provisions of all federal and state laws and regulation by assuring that no person shall be excluded from consideration for recruitment, selection, appointment, training, promotion, retention, or any other personnel action, or be denied any benefits or participation in any programs of activities which it operates on the grounds of race, religion, color, national origin, sex, handicap, age, or veteran status (except where age, sex, or handicap constitute a bona fide occupational qualification necessary to proper and efficient administration). The Texas Education Agency makes positive efforts to employ and advance in employment all protected groups.

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Introduction

OBJECTIVES

After students have covered the material in this unit, they should be able to—

1. tell why they should study construction;
2. define construction;
3. understand the impact of construction on society;
4. be able to describe the difference between the three types of construction, and give examples of each; and
5. practice the importance of safety in the construction industry and apply good safety practices and procedures in their work.

KEY WORDS: VOCABULARY

The words in the following list may be new to the students studying construction. Teachers should help students understand these words as they are used in this topic of study.

technology
construction
residential construction
commercial construction
civil construction
alternative energy
energy conservation
protective equipment
preconstruction
postconstruction

TEACHING AIDS

- Overhead projector
- Appendices A and B
- Test Key: 1-A, 2-C, 3-D, 4-C, 5-A, 6-B
- Transparencies: You will find transparencies C1-1 through C1-8 at the end of this unit. If you wish, these masters may be duplicated in quantity and given as handouts to the students while they are studying the different aspects of this unit.

C1-1: Construction Technology
C1-2: What Is Technology?
C1-3: Environmental Influences on Construction
C1-4: Uses of Alternative Energy in Construction
C1-5: Future Trends in Construction
C1-6: Three Types of Construction
C1-7: Construction Safety
C1-8: Protective Equipment

SUGGESTED REFERENCES

Bame, E. A., and Cummings, P. Exploring Technology. Worchester, Mass.: Davis Publications, 1980.

Betts, M. Roger; Hausenstein, A. Dean; and Fannin, John. Exploring the Construction Industry. Bloomington, Ill.: McKnight Publishing Company, 1976.

Huth, Mark. Introduction to Construction. Albany, N. Y.: Delmar Publishers, 1980.

Landers, Jack M. Construction Materials, Methods, Careers. South Holland, Ill.: Goodheart-Willcox Company, 1983.

Lux, Donald G.; Ray, Willis E.; Blankenbaker, E. Keith; and Umstattd, William. World of Construction. Bloomington, Ill.: McKnight Publishing Company, 1982.

SENTENCE OUTLINE

I. Why study construction?
  A. Construction technology is the study of designing, planning, and erecting a structure on-site. (Transparency C1-1)
  B. This study should develop a better understanding of the impact of construction on society.
  C. In the last decade, the energy shortage has created new construction problems that have led to new designs, techniques, and materials.
  D. The use of alternative energy in construction has influenced the advancement of technological progress.

II. The impact of construction on society
  A. With the construction of crude shelters by primitive humans, technology was born.
  B. Technology is people using tools and techniques in their most efficient way. (Transparency C1-2)
  C. Structures are designed to meet some human need.
  D. Construction provides homes in which we live, commercial and industrial buildings in which we work, and transportation networks in which we travel.
  E. Environmental influences have greatly affected and changed the design, techniques, and building of structures. (Transparency C1-3)
  F. The use of alternative energy sources has greatly influenced the way structures are designed and built. (Transparency C1-4)
  G. Future trends will change the construction industry. (Transparency C1-5)
    1. The change in our society from an industrial society to a postindustrial, information society will have a great impact on the construction industry.
    2. A major problem facing the construction industry in the future will be analyzing growth patterns and energy supplies and demands to determine how and where people will live, work, and travel.
    3. Renovation projects will become more important in the future.
    4. More efficient mass transit and transportation networks will be needed to handle land and air transportation.
    5. Energy conservation and air pollution reduction will become more important in the construction industry.
    6. Construction materials are continually changing and will provide more flexibility in construction design and fabrication.

III. Three types of construction systems. (Transparency C1-6)
  A. Residential construction is the building of homes, apartments, and other living dwellings on-site.
  B. Commercial construction is the erection of structures designed for commercial and industrial purposes, such as schools, office buildings, shopping centers and malls, industries, power plants, and others.
  C. Civil construction is the construction of highways, dams, railways, bridges, and other types of transportation systems.
  D. The three types of construction can be divided into the following phases:
    1. preconstruction
    2. construction
    3. postconstruction

IV. Construction safety and technology (Transparency C1-7)
  A. An employee's health and safety is the most important consideration in the construction industry.
  B. The construction industry has many dangerous and hazardous jobs that could create potentially harmful conditions for employees.

C. It is important that construction companies provide safety training and awareness for their employees.

D. The Occupational Safety and Health Act (OSHA) requires contractors to provide a safe working environment for their employees. The Occupational Safety and Health Administration enforces and administers the provisions of the Act.

E. It is important that construction employees use certain personal protective equipment while they work. (Transparency C1-8)
   1. Protective hard hat: This is worn to protect the worker from head injury due to falling objects.
   2. Eye protection devices: Safety glasses, goggles, and shields are used to protect the eyes from flying objects and arcs from welding arcs.
   3. Hearing protection devices: Earplugs and earmuffs protect the worker's ears from high levels of noise for long periods of time.
   4. Protective gloves: gloves are worn to protect the worker's hands from blisters, burns, and cuts when handling rough material and chemicals, and from the heat and radiation of welding.
   5. Protective shoes: These specially designed shoes help prevent the worker's feet from being injured if heavy materials fall on them.
   6. Respirators: These protect the worker from breathing hazardous fumes and dust particles.

MATERIALS FOR STUDENTS

- Vocabulary worksheet
- Handouts
- Newspapers and magazines for bulletin board idea
- Pencil, paper, scissors, and so on

SUGGESTED STUDENT ACTIVITIES

1. Design and construct a bulletin board depicting construction technology. Ask students to collect and bring in articles, pictures, and posters related to construction technology.
   Transparency C1-1: Construction Technology
   Transparency C1-2: What Is Technology?
2. Identify and discuss new technologies in the construction industry. Ask students to look through newspapers and magazines and bring in articles on new technologies in the construction industry.
   Transparency C1-3: Environmental Influences on Construction
   Transparency C1-4: Uses of Alternative Energy in Construction
   Transparency C1-5: Future Trends in Construction

Suggested ideas of new technologies in the construction industry:

- alternative energy sources
- new construction materials and techniques
- future trends that will affect the construction industry
- new equipment being used in the construction industry

3. Identify and discuss the three types of construction, and have students give examples of each.

Transparency C1-6: Three Types of Construction

- Residential Construction
  - conventional houses (ranch, colonial, split-foyer, trilevel, and so on)
  - log houses
  - solar houses
  - underground houses
  - dome houses
- Commercial construction
  - office buildings
  - schools
  - churches
  - shopping centers and malls
  - libraries
  - industries
- Civil Construction
  - streets and roads
  - interstate networks
  - railroads
  - bridges
  - dams
  - driveways
  - canals and waterways

4. Have students work in groups and conduct a safety inspection of the industrial arts facilities. Identify and discuss the findings of the inspection. Then have the students make recommendations on what they think should be done to correct the problems. See the Industrial Arts Laboratory Safety Checklist.
5. The students will organize and participate in a Safety Poster Contest sponsored by the local AIASA chapter and a local construction industry.
   Transparency C1-7: Construction Safety
   Transparency C1-8: Protective Equipment
   Suggested ideas for Safety Poster Contest
   - Organize a Safety Poster Committee to establish the rules for the contest and to contact the construction company.
   - The Safety Poster Contest Committee will meet with the safety engineer or director of the construction company and tour several of their sites to determine the basic safety concerns and needs of the company. (If possible, videotape the tour.)
   - Have the safety engineer or director of the construction company speak to the class.
   - Set up an awards and recognition program with the safety engineer or director of the company.

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NATIONAL STANDARD SCHOOL SHOP SAFETY INSPECTION CHECK LIST
Prepared by the Joint Safety Committee of the
AMERICAN VOCATIONAL ASSOCIATION – NATIONAL SAFETY COUNCIL

______________________________ Date ______________

____

INTRODUCTION

A safe environment is an essential part of the school shop safety education program. The safe environment will exist only if hazards are discovered and corrected through *regular* and *frequent* inspections by school personnel – administrators, teachers and students. Safety inspections are to determine if everything is satisfactory.

Inspections may be made at the request of the board of education, the school administration or upon the initiative of the teacher. Some communities have drawn upon the cooperative service of professional safety engineers, inspectors of state labor departments, insurance companies and local safety councils to supplement and confirm inspections by school personnel.

The National Standard School Shop Safety Inspection Check List, recommended by the President's Conference on Industrial Safety is an objective inspection procedure for the school shop.

DIRECTIONS

WHO INSPECTS?

This will depend upon local policies. It is recommended, however, that shop teachers, and students – the student safety engineer and/or student safety committee – participate in making regular inspections.

This not only tends to share responsibility but stimulates a broader interest in the maintenance of a safe school shop.

WHEN TO INSPECT?

As a minimum, a safety inspection should be made at the beginning of every school term or semester. More frequent inspections may be advisable.

HOW TO INSPECT?

Inspections should be well planned in advance.

Inspections should be systematic and thorough. No location that may contain a hazard should be overlooked.

Inspection reports should be clear and concise, but with sufficient explanation to make each recommendation for improvement understandable.

FOLLOW-UP

The current report should be compared with previous records to determine progress. The report should be studied in terms of the accident situation so that special attention can be given to those conditions and locations which are accident producers.

Each unsafe condition should be corrected as soon as possible in accordance with accepted local procedures.

A definite policy should be established in regard to taking materials and equipment out of service because of unsafe conditions.

The inspection report can be used to advantage as the subject for staff and class discussion.

CHECKING PROCEDURE

Draw a circle around the appropriate letter, using the following letter scheme:

S – Satisfactory (needs no attention)
A – Acceptable (needs some attention)
U – Unsatisfactory (needs immediate attention)

Recommendations should be made in all cases where a "U" is circled.

Space is provided at the end of the form for such comments. Designate the items covered by the recommendations, using the code number applicable (as B-2).

In most categories, space is provided for listing of standards, requirements or regulations which have local application only.

A. GENERAL PHYSICAL CONDITION

1. Machines, benches, and other equipment are arranged so as to conform to good safety practices	S	A	U
2. Condition of stairways	S	A	U
3. Condition of aisles	S	A	U
4. Condition of floors	S	A	U
5. Condition of walls, windows, and ceiling	S	A	U
6. Illumination is safe, sufficient, and well placed	S	A	U
7. Ventilation is adequate and proper for conditions	S	A	U
8. Temperature control	S	A	U
9. Fire extinguishers are of proper type, adequately supplied, properly located and maintained	S	A	U
10. Teacher and pupils know location of and how to use proper type for various fires	S	A	U
11. Number and location of exits is adequate and properly identified	S	A	U
12. Proper procedures have been formulated for emptying the room of pupils and taking adequate precautions in case of emergencies	S	A	U
13. Lockers are inspected regularly for cleanliness and fire hazards	S	A	U
14. Locker doors are kept closed	S	A	U
15. Walls are clear of objects that might fall	S	A	U
16. Utility lines are properly identified	S	A	U
17. Teachers know the procedure in the event of fire including notification of the fire department and the evacuation of the building	S	A	U
18. Air in shop is free from excessive dust, smoke, etc.	S	A	U
19. ______________	S	A	U
20. ______________	S	A	U
21. ______________	S	A	U
22. ______________	S	A	U
23. Evaluation for the total rating of A. GENERAL PHYSICAL CONDITION	S	A	U

B. HOUSEKEEPING

1. General appearance as to orderliness . . . S A U
2. Adequate and proper storage space for tools and materials . . . S A U
3. Benches are kept orderly . . . S A U
4. Corners are clean and clear . . . S A U
5. Special tool racks, in orderly condition, and provided at benches and machines . . . S A U
6. Tool, supply, and/or material room is orderly . . . S A U
7. Sufficient scrap boxes are provided . . . S A U
8. Scrap stock is put in scrap boxes promptly . . . S A U
9. Materials are stored in an orderly and safe condition . . . S A U
10. A spring lid metal container is provided for waste and oily rags . . . S A U
11. All waste materials and oily rags are promptly placed in the containers . . . S A U
12. Containers for oily rags and waste materials are frequently and regularly emptied . . . S A U
13. Dangerous materials are stored in metal cabinets . . . S A U
14. Machines have been color conditioned . . . S A U
15. Safety cans are provided for flammable liquids . . . S A U
16. Bulk storage of dangerous materials is provided outside of the main building . . . S A U
17. A toe-board or railing around a mezzanine used for storage or washing facilities . . . S A U
18. Materials are stored in an orderly and safe condition on this mezzanine . . . S A U
19. Flammable liquids are not used for cleaning purposes . . . S A U
20. Floors are free of oil, water and foreign material . . . S A U
21. Floors, walls, windows, and ceilings are cleaned periodically . . . S A U
22. ______________________ S A U
23. ______________________ S A U
24. ______________________ S A U
25. ______________________ S A U
26. Evaluation for the total rating for B. HOUSEKEEPING S A U

C. EQUIPMENT

1. Machines are arranged so that workers are protected from hazards of other machines, passing students, etc. . . . S A U
2. Danger zones are properly indicated and guarded . . . S A U
3. All gears, moving belts, etc., are protected by permanent enclosure guards . . . S A U
4. All guards are used as much as possible . . . S A U
5. All equipment control switches are easily available to operator . . . S A U
6. All machines are "locked off" when instructor is out of the room . . . S A U
7. Brushes are used for cleaning equipment . . . S A U
8. Nonskid areas are provided around machines . . . S A U
9. Machines are in safe working condition . . . S A U
10. Machines are guarded to comply with American Standards Association and local state code . . . S A U
11. Adequate supervision is maintained when students are using machines and dangerous tools . . . S A U
12. Tools are kept sharp, clean and in safe working order . . . S A U
13. All hoisting devices are in safe operating condition . . . S A U
14. Machines are shut off while unattended . . . S A U

C. EQUIPMENT (continued)

15. Adequate storage facilities for tools, equipment, etc., not in immediate use . . . S A U
16. ______________________ S A U
17. ______________________ S A U
18. ______________________ S A U
19. ______________________ S A U
20. Evaluation for the total rating for C. EQUIPMENT . . . S A U

D. ELECTRICAL INSTALLATION

1. All switches are enclosed . . . S A U
2. There is a master control switch for all of the electrical installations . . . S A U
3. Electrical outlets and circuits are properly identified . . . S A U
4. All electrical extension cords are in safe condition and are not carrying excessive loads . . . S A U
5. All machine switches are within easy reach of the operators . . . S A U
6. Electrical motors and equipment are wired to comply with the National Electric Code . . . S A U
7. Individual cut-off switches are provided for each machine . . . S A U
8. Machines are provided with overload and underload controls by magnetic pushbutton controls . . . S A U
9. No temporary wiring in evidence . . . S A U
10. ______________________ S A U
11. ______________________ S A U
12. ______________________ S A U
13. ______________________ S A U
14. Evaluation for the total rating for D. ELECTRICAL INSTALLATION . . . S A U

E. GAS

1. Gas flow to appliances is regulated, so that when appliance valve is turned on full, the flames are not too high . . . S A U
2. Gas appliances are properly insulated with asbestos or other insulating material from tables, benches, adjacent walls, or other flammable materials . . . S A U
3. No gas hose is used where pipe connections could be made . . . S A U
4. Gas appliances have been adjusted so that they may be lighted without undue hazard . . . S A U
5. Students have been instructed when lighting gas appliances to light the match first before turning on the gas . . . S A U
6. There are no gas leaks, nor is any odor of gas detectable in any part of the shop . . . S A U
7. Shop instruction has been given concerning the lighting of gas furnaces operating with both air and gas under pressure . . . S A U
8. When lighting the gas forge, goggles are worn . . . S A U
9. When lighting the gas furnace, the following procedure is used: (a) light the match; (b) turn on the gas; (c) drop the match in the hole in top of the furnace . . . S A U
10. In shutting down the gas furnace, the gas valve is closed before the air valve . . . S A U
11. ______________________ S A U
12. ______________________ S A U
13. ______________________ S A U

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E. GAS (continued)

14. ______________________ S A U

15. Evaluation for the total rating for E. GAS .... S A U

F. PERSONAL PROTECTION

1. Goggles or protective shields are provided and required for all work where eye hazards exist .... S A U

2. If individual goggles are not provided, hoods and goggles are properly disinfected before use .... S A U

3. Shields and goggles are provided for electric welding .... S A U

4. Rings and other jewelry are removed by pupils when working in the shop .... S A U

5. Proper kind of wearing apparel is worn and worn properly for the job being done .... S A U

6. Leggings, safety shoes, etc., are worn in special classes such as foundry, etc., when needed .... S A U

7. Respirators are provided for dusty or toxic atmoshperic conditions such as when spraying in the finishing room ..... S A U

8. Provisions are made for cleaning and sterilizing respirators .... S A U

9. Students are examined for safety knowledge ability .... S A U

10. Sleeves are rolled above elbows when operating machines S A U

11. Clothing of students is free from loose sleeves, flopping ties, loose coats, etc .... S A U

12. ______________________ S A U

13. ______________________ S A U

14. ______________________ S A U

15. ______________________ S A U

16. Evaluation for the total rating for F. PERSONAL PROTECTION .... S A U

G. INSTRUCTION

1. Shop Safety is taught as an integral part of each teaching unit .... S A U

2. Safety rules are posted particularly at each danger station .... S A U

3. Printed safety rules are given each student .... S A U

4. Pupils take a safety pledge .... S A U

5. Use of a safety inspector .... S A U

6. Use of a student shop safety committee .... S A U

7. Use of safety contests .... S A U

8. Motion and/or slide films on safety are used in the instruction .... S A U

9. Use of suggestion box .... S A U

10. Use of safety tests .... S A U

11. Use of safety posters .... S A U

12. Talks on safety are given to the classes by industrial personnel .... S A U

13. Tours are taken of industrial plants as a means of studying safety practices .... S A U

14. Periodic safety inspections of the shop are made by a student committee .... S A U

15. Personnel from industry make safety inspections of the shop .... S A U

16. Student shop safety committee investigates all accidents. S A U

17. A proper record is kept of safety instructions which are given, preferably showing the signature of student on tests given in this area .... S A U

G. INSTRUCTION (continued)

18. Rotate students on the Shop Safety Committee so that as many students as possible have an opportunity to participate S A U

19. ______________________ S A U

20. ______________________ S A U

21. ______________________ S A U

22. ______________________ S A U

23. Evaluation for the total rating of G. INSTRUCTION. S A U

H. ACCIDENT RECORDS

1. There is a written statement outlining the proper procedure when and if a student is seriously hurt .... S A U

2. Adequate accident statistics are kept .... S A U

3. Accidents are reported to the proper administrative authority by the instructor .... S A U

4. A copy of each accident report is filed with the State Department of Education .... S A U

5. Accident reports are analyzed for instructional purposes and to furnish the basis for elimination of hazards .... S A U

6. ______________________ S A U

7. ______________________ S A U

8. ______________________ S A U

9. ______________________ S A U

10. Evaluation for the total rating of H. ACCIDENT RECORDS .... S A U

I. FIRST AID

1. An adequately stocked first aid cabinet is provided .... S A U

2. The first aid is administered by a qualified individual .. S A U

3. The school has individuals qualified to administer first aid .... S A U

4. .... S A U

5. .... S A U

6. .... S A U

7. .... S A U

8. Evaluation for the total rating of I. FIRST AID..... S A U

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RECOMMENDATIONS

Code No.	

HAZARDOUS CONDITIONS REPORT

This is a suggested method for reporting the hazard and directing action to see that the hazard is corrected or removed.

If a hazard exists, the operation should be "red tagged" and shut down until corrected.

HAZARDOUS CONDITIONS REPORT

Date ______________________

To: ____
(Building Administrator) (Position) (School)

Description and Location of Health or Safety Hazard: ______________________

____

____

____

Suggested Solution: ______________________________

____

____

Teacher Signature: ______________________

Distribution: Original - Building Administrator
1st Copy - Department Head
2nd Copy - Teacher Reporting Hazard
3rd Copy - District Safety Officer

Action Taken: ______________________________

____

____

____

By Whom: ______________________
(Signature)

Vocabulary Worksheet

1. technology
2. construction
3. residential construction
4. commercial construction
5. civil construction
6. alternative energy
7. energy conservation
8. protective equipment
9. preconstruction
10. postconstruction

TEST

Unit 1: Introduction to Construction

Directions: Read each statement carefully. Select the word or phrase that correctly answers or completes the statement, and write the appropriate letter in the blank.

Example: __D__ 21. The class that you are in is—

A. Health
B. Science
C. Art
D. Industrial Arts

___ 1. The study of designing, planning, and erecting a structure on-site is—
A. construction technology
B. building technology
C. material technology
D. tooling technology

___ 2. People using tools and techniques in their most efficient way is—
A. tooling
B. management
C. technology
D. material technology

___ 3. The building of homes, apartments, and other living dwellings on-site is—
A. civil construction
B. human construction
C. commercial construction
D. residential construction

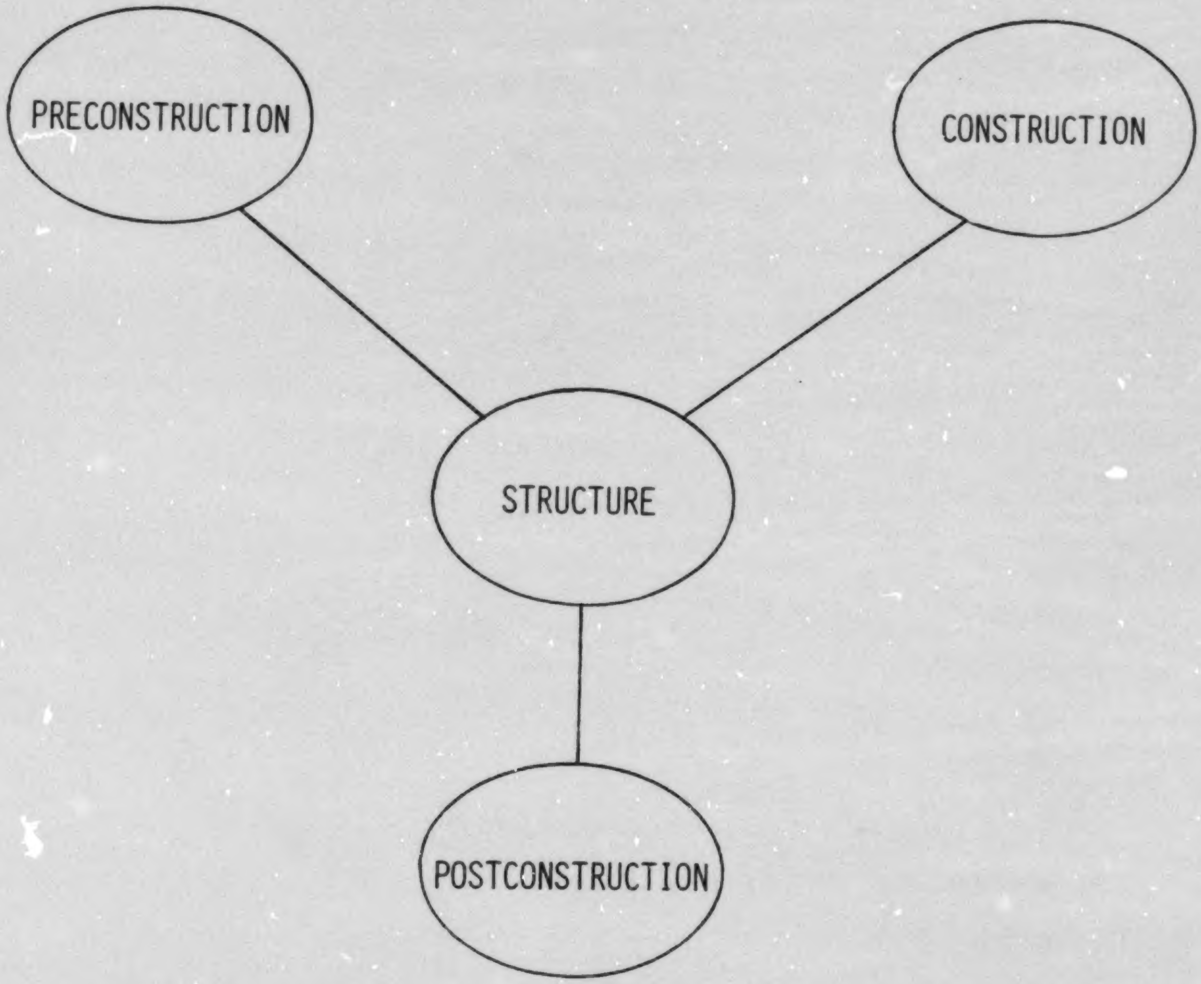
___ 4. The erection of structures designed for commercial and industrial purposes, such as schools, office buildings, shopping centers and malls, industries, and power plants, is—
A. civil construction
B. human construction
C. commercial construction
D. residential construction

___ 5. The construction of highways, dams, railways, bridges, and other types of transportation systems is—
A. civil construction
B. human construction
C. commercial construction
D. residential construction

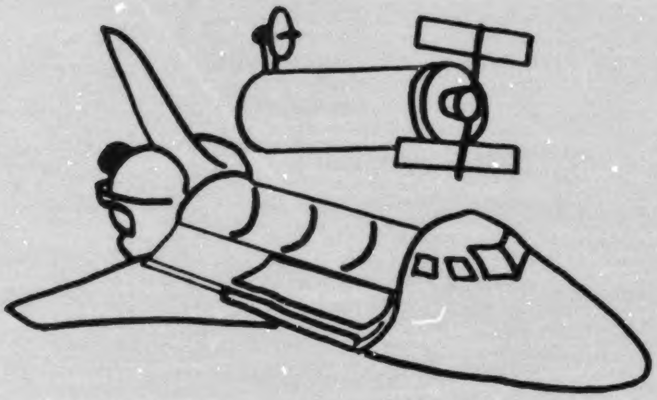
___ 6. The agency that enforces and administers construction sites so that contractors are providing a safe working environment and conditions for their employees is (the)—

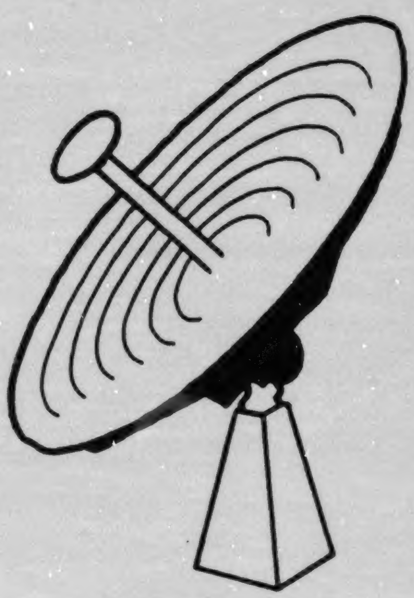
A. Welfare Board
B. Occupational Safety and Health Administration
C. Environmental Protection Agency
D. NASA

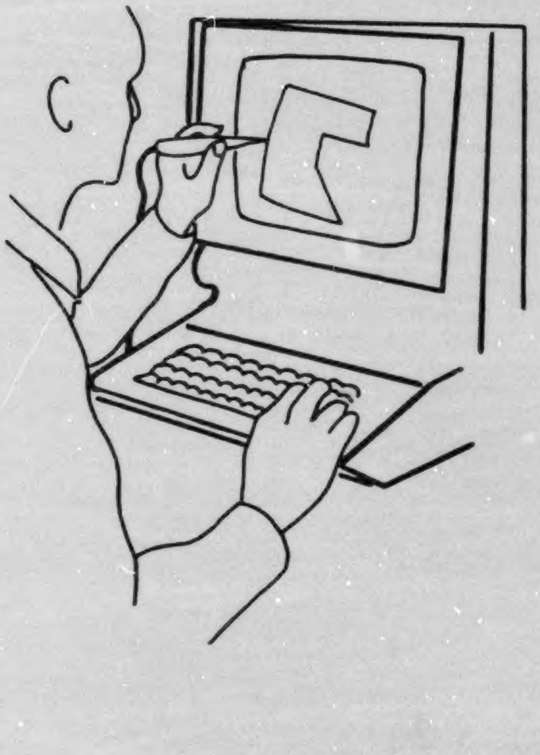
CONSTRUCTION TECHNOLOGY

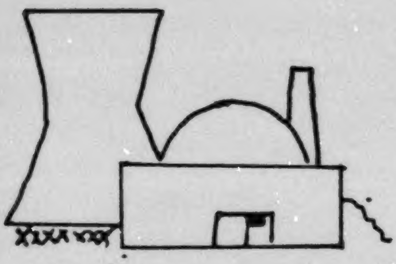

PRECONSTRUCTION
CONSTRUCTION
STRUCTURE
POSTCONSTRUCTION

WHAT IS TECHNOLOGY?

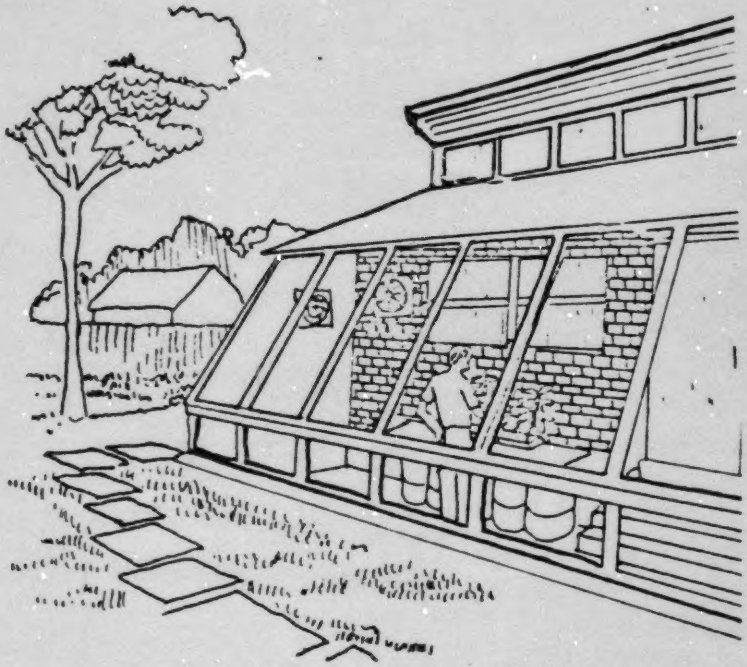






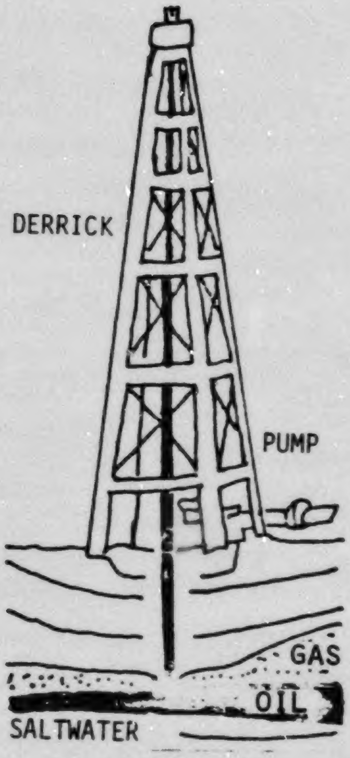


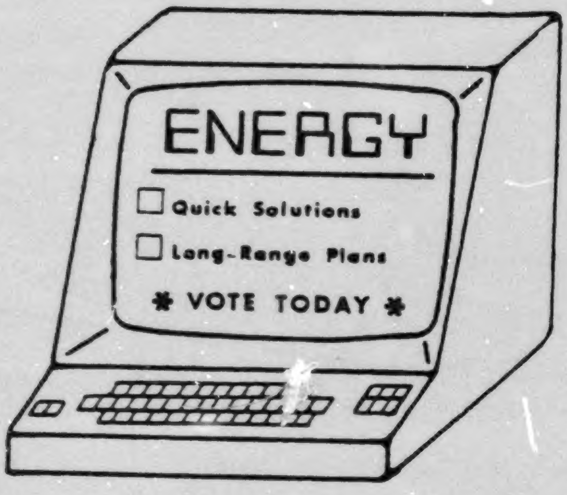
NUCLEAR POWER PLANT



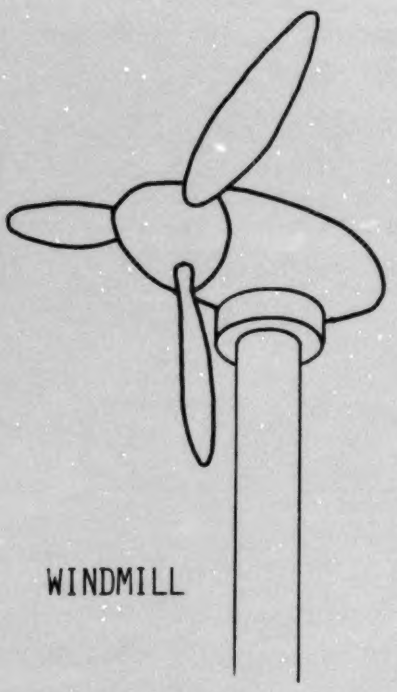
SOLAR

ENVIRONMENTAL INFLUENCES ON CONSTRUCTION

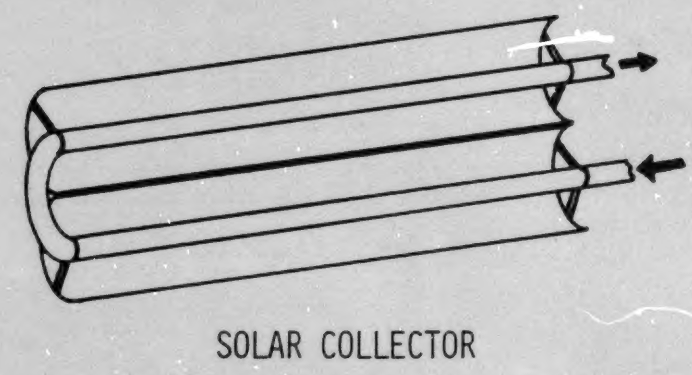

DERRICK
PUMP
GAS
OIL
SALTWATER


ENERGY
☐ Quick Solutions
☐ Long-Range Plans
* VOTE TODAY *

USE OF ALTERNATIVE ENERGY IN CONSTRUCTION

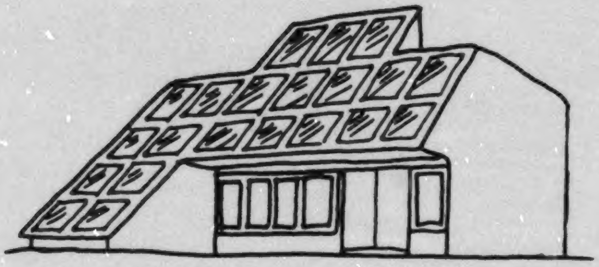


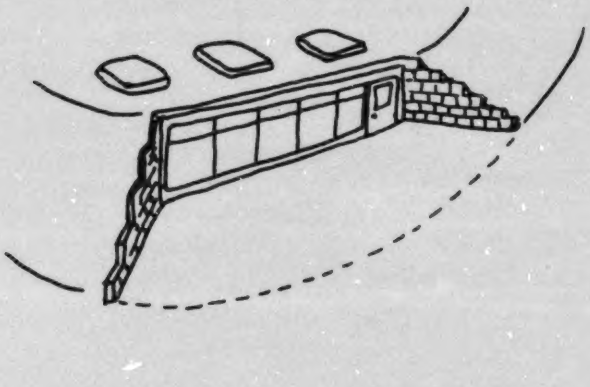
WINDMILL



SOLAR COLLECTOR

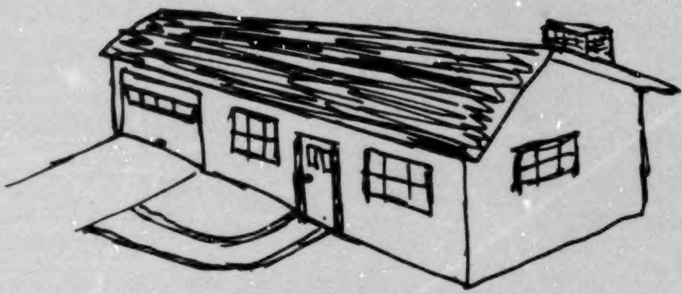
FUTURISTIC TRENDS IN CONSTRUCTION



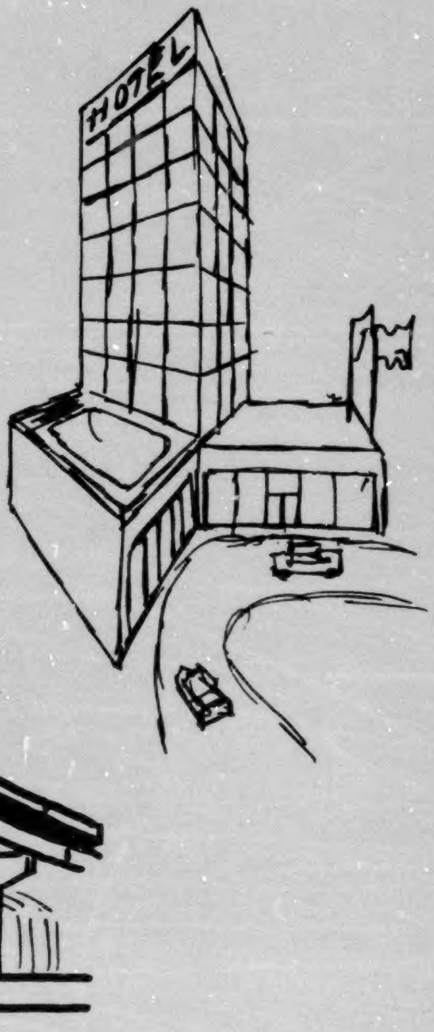


THREE TYPES OF CONSTRUCTION

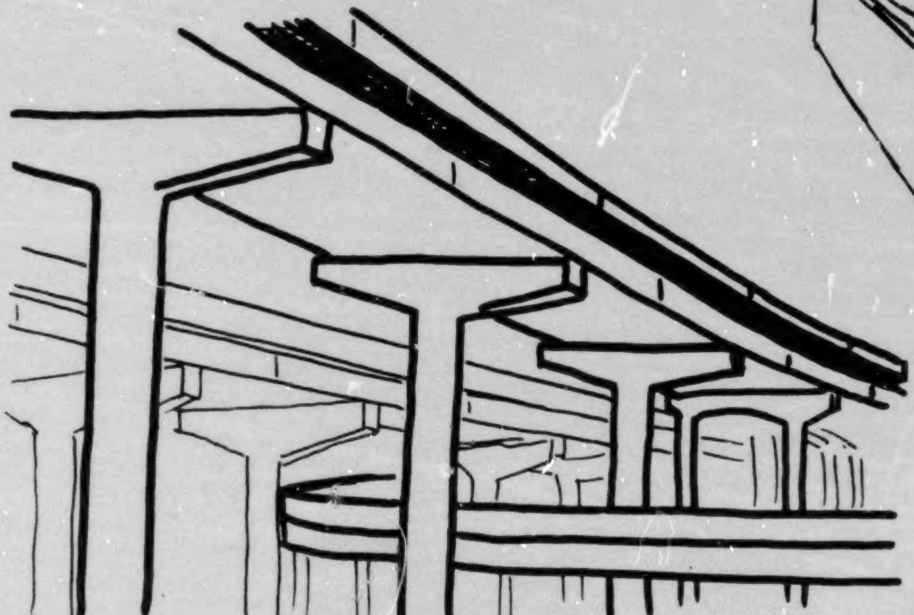
I. RESIDENTIAL

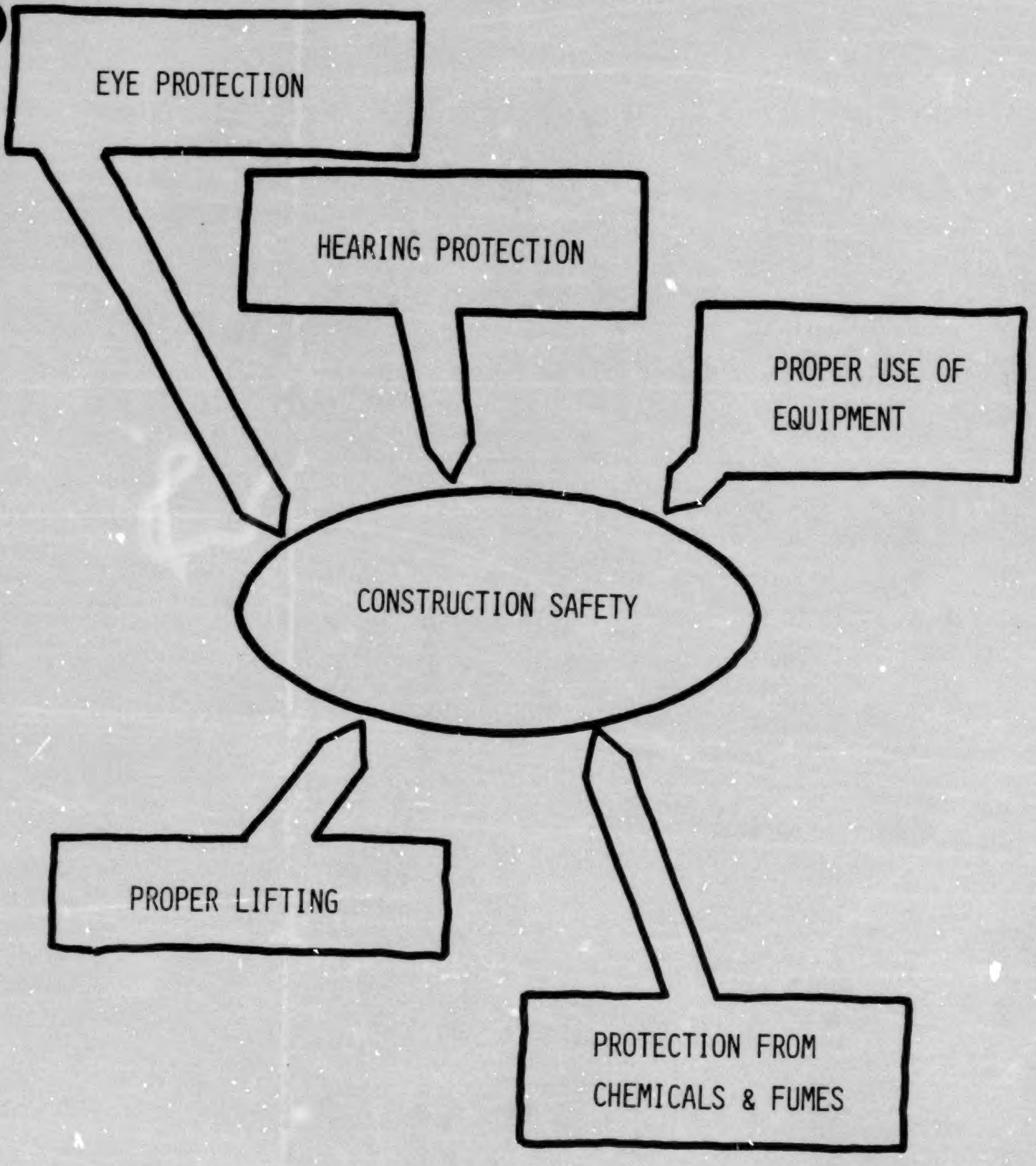


II. COMMERCIAL



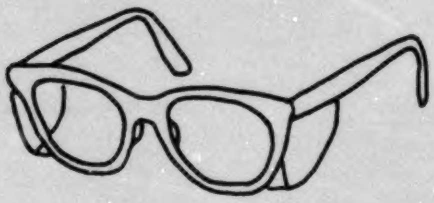
III. CIVIL



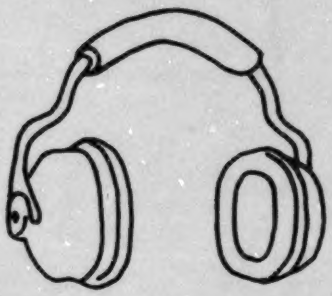

EYE PROTECTION
HEARING PROTECTION
PROPER USE OF EQUIPMENT
CONSTRUCTION SAFETY
PROPER LIFTING
PROTECTION FROM CHEMICALS & FUMES

PROTECTIVE EQUIPMENT

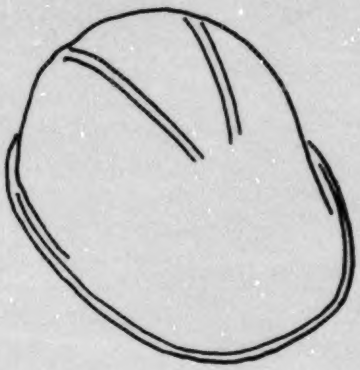
SAFETY GLASSES



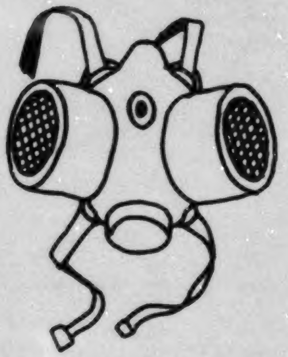
HEARING PROTECTOR

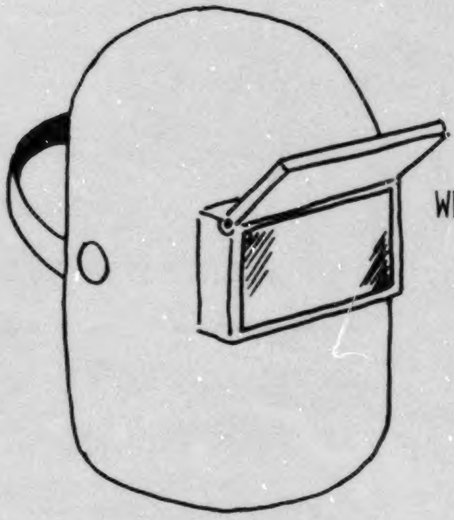


HARD CAP



RESPIRATOR





WELDING HELMET

2

Preconstruction

OBJECTIVES

After students have covered the material in this unit, they should be able to—

1. identify the basic processes of selecting and purchasing a site;
2. list and distinguish between the different types of surveys and understand the basic principles of surveying and mapping;
3. relate the basic procedures of soil testing and the reasons for testing soil; and
4. apply good design principles and problem-solving skills as they relate to construction.

KEY WORDS: VOCABULARY

The word in the following list may be new to the student studying construction. Teachers should help students understand these words as they are used in this topic of study.

- negotiation
- condemnation
- power of eminent domain
- abstract
- closing
- deed
- zoning
- building code
- feasibility study
- design factors
- surveying
- land survey
- topographic survey
- route survey
- hydrographic survey
- aerial survey
- construction survey
- soil testing
- load-bearing surface
- shoring
- soil analysis
- water table
- test pits
- design process
- problem solving
- traffic flow
- horizontal control
- vertical control
- transit
- level
- benchmark
- contour map
- topographic map

TEACHING AIDS

- Overhead projector
- Appendices A and B
- Test Key: 1-A, 2-B, 3-D, 4-B, 5-D, 6-C, 7-B, 8-A, 9-B, 10-A
- Transparencies: You will find transparencies C2-1 through C2-13 at the end of this unit. If you wish, these masters may be duplicated in quantity and given as handouts to the students while they are studying the different aspects of this unit.

C2-1: Selecting the Site
C2-2: Criteria for Selecting a Site
C2-3: Difference between Negotiation and Condemnation
C2-4: Types of Surveys
C2-5: Surveying Equipment
C2-6: Contour Map

C2-7: Topographic
C2-8: Relationship of Problem Solving to the Design Process
C2-9: Basic Elements of Design
C2-10: Principles of Design
C2-11: New Construction Materials and Methods
C2-12: Orientation of Structure
C2-13: Areas of a House

SUGGESTED REFERENCES

Bame, E. A., and Cummings, P. Exploring Technology. Worchester, Mass.: Davis Publications, 1980.

Betts, M. Roger; Hausenstein, A. Dean; and Fannin, John. Exploring the Construction Industry. Bloomington, Ill.: McKnight Publishing Company, 1976.

Hepler, Donald E., and Wallach, Paul I. Architecture Drafting and Design. New York: McGraw-Hill Book Company, 1977.

Huth, Mark. Introduction to Construction. Albany, N. Y.: Delmar Publishers, 1980.

Landers, Jack M. Construction Materials, Methods, Careers. South Holland, Ill.: Goodheart-Willcox Company, 1983.

Lux, Donald G.; Ray, Willis E.; Blankenbaker, E. Keith; and Umstattd, William. World of Construction. Bloomington, Ill.: McKnight Publishing Company, 1982.

SENTENCE OUTLINE

I. Introduction
   A. For purposes of discussion, we will divide preconstruction into two categories:
      1. beginning the site
      2. construction drafting and design
   B. We will further divide each category into subcategories to help the student understand the vast array of preconstruction.
II. Beginning the site
   A. Selecting the site
      1. The selection of a good site for a structure means the site must be—
         a. in a good location; (Transparency C2-1)
         b. available;
         c. such that the structure will look good on it;
         d. useful; and
         e. affordable
      2. In selecting any site for a structure, it is necessary to observe the following criteria: (Transparency C2-2)
         a. Is there a good community environment?
         b. Are the necessary utilities available and affordable?
         c. Is there a good transportation network?
         d. Is the supply of labor adequate?
         e. Is the site useful?
         f. Is there a market for your product?
         g. How is the site zoned?
         h. Is the climate suitable?
      3. Feasibility studies are conducted to determine which site best meets the above criteria.
      4. A site may be acquired in two ways. (Transparency C2-3)
         a. Through **negotiations**, the owner and buyer discuss the property and agree upon the selling price and the terms of the settlement.
            1. A **realtor** may be used on behalf of the owner and/or buyer in negotiating the contract and settlement.

2. When the terms are agreed upon by both parties, a **contract** is written and signed by both parties.
b. **Condemnation** is used on many government and public projects when the owner refuses to sell the land.
1. The power of eminent domain gives the government the right to obtain property for public use, through a fair settlement to the owner.
2. Condemnation is used most commonly in civil construction projects to obtain right-of-ways for highways or dams.
5. Finalizing the purchase of a site: After the agreement has been reached, a closing is held to finalize the agreement.
a. Both the seller and the buyer, and their lawyers and real estate agents attend a meeting to sign all the necessary papers and clear up any questions regarding the property.
b. After the closing, the buyer's lawyer takes the deed, abstract, and site survey to the courthouse to have the documents recorded and identified as the property of the legal owner.

B. Surveying and mapping
1. A survey is made of a site to determine the natural and artificial features of the site.
2. Six basic types of surveys can be made on a site: (Transparency C2-4)
a. **Topographic surveys** are used to determine the terrain of a site.
b. **Land surveys** are used to determine the boundaries of a site.
c. **Route surveys** are used to determine road and highway alignment.
d. **Aerial surveys** are used to survey large tracts of land from the air.
e. **Construction surveys** are used to locate a structure on a site.
f. **Hydrographic surveys** are used to survey bodies of water.
3. Any point on earth can be determined by using latitudinal points (horizontal control) and longitudinal points (vertical control).
a. The **horizontal control** is the known point on the earth's surface.
b. The **vertical control** is the elevation of that known point.
c. **Benchmarks** or **monuments** are placed when the elevation is found so that future surveys can be started from that point.
4. Surveying equipment (Transparency C2-5)
a. A **transit** measures both horizontal and vertical angles.
b. A **level** is used to find an unknown elevation from a known point.
c. New technology has produced a radio-controlled laser beam to find elevation.
5. Mapping
a. The **contour map** shows changes in the height and shape of a site. (Transparency C2-6)
b. The **topographic map** shows the elevations of specific points of a tract of land. (Transparency C2-7)

C. Soil testing
1. Soil testing is done to determine the nature of the soil in a site.
2. Soil testing is critical to determine the type of foundation and footings a structure needs.
3. A soil analysis can be done to determine the soil characteristics.
4. The soil analysis can be done by government agencies in a laboratory or it can be done on-site.

III. Construction drafting and design
A. Problem solving and the design process (Transparency C2-8)
1. Problem solving is the basis of good design.
2. Problem solving helps us to organize things in a logical and systematic order to reach a valid solution to the problem.

3. The following eight (8) steps show the relationship of problem solving to the design process.
   a. identifying the design problem
   b. creating preliminary ideas
   c. refining ideas
   d. analyzing ideas
   e. selecting the design
   f. implementing the design
4. All structures should contain the basic elements of design: (Transparency C2-9)
   a. form
   b. color
   c. line
   d. texture
   e. space
   f. light and shadow
5. The design is tied together through the principles of design: (Transparency C2-10)
   a. balance
   b. unity
   c. rhythm
   d. emphasis
   e. repetition
   f. variety
6. Technological advances and new materials (Transparency C2-11)
   a. Advancement in construction technology is based on the availability of materials.
   b. Wood, ceramics, and stone materials have been used for many, many years in construction.
   c. New developments in wood, such as plywood, hardwood, particleboard, and others, have provided more flexibility to construction design.
   d. High-rise and skyscraper construction have been made possible through the use of steel and glass materials.
   e. Plastic and glass products have revolutionized the construction industry by providing architects with many innovative and creative design possibilities.
   f. Through the use of reinforced and prestressed concrete, new structural designs are now possible.
   g. The use of aluminum has provided a great deal of flexibility in designing structures.
7. Technological advances and new construction methods
   a. The development of new construction materials has, likewise, led to the development of new construction methods and techniques.
   b. Through the use of new materials, the length of span that can be supported has increased.
   c. New technological advances in construction and new methods, such as skeleton-frame, curtain-wall, and cantilevered techniques, have opened the door to many new structural designs in commercial and civil construction.
   d. The use of alternative energy sources has altered the design and orientation of structures to optimize their use.
8. Orientation (Transparency C2-12)
   a. Orientation is critical to the overall efficiency of the construction project so that the structure will be properly located on the site.
   b. Proper orientation of a structure means that the building should be located to provide optimum resistance to the winter cold and to filter out the summer heat.

c. The southern exposure of the structure has almost continuous sun.
d. The northern exposure is cooler because of northerly winds and the lack of sunshine.
e. The structure should be located to reduce noise and wind.
f. The location of the structure must meet all building codes.
g. The three basic areas of a house (public, private, and service) are affected by its orientation. (Transparency C2-13)
    1. The kitchen should be located on the east to get the morning sun.
    2. The living area should be located on the southern and western exposures to get the late afternoon sun.
    3. The private area of the house should be located on the northern exposure because it is the coolest side of the house and will provide fresh air due to wind currents.

MATERIALS FOR STUDENTS

- Vocabulary worksheet
- Handouts
- Surveying equipment
- Soil testing equipment
- Drawing paper, pencils, and drawing instruments

SUGGESTED STUDENT ACTIVITIES

1. Give the students three maps of proposed sites for a structure and have them work in groups. They are to analyze and classify the sites by priority, making recommendations, about the best possible site for the structure.
   Transparency C2-1: Selecting the Site
   Transparency C2-2: Criteria for Selecting a Site
2. Have an architect speak to the class, or videotape the presentation if the architect cannot speak in person.
3. Have the students divide into groups to form surveying parties. Give each group a hypothetical case study with a known benchmark. Then have each group lay out the corners of the structure.
   Transparency C2-4: Types of Surveys
   Transparency C2-5: Surveying Equipment
4. Have the students draw a contour map of their survey.
   Transparency C2-6: Contour Map
5. Have the students draw a topographic map of their survey.
   Transparency C2-7: Topographic Map
6. Have the county extension agent demonstrate to the class soil testing, the equipment, and procedures. If the agent cannot visit the class, have students videotape the agent's presentation.
7. Have the students take a soil sample from their home and bring it in to be analyzed. If the school does not have soil testing equipment, send the student samples to the county extension agent for analysis.
8. Videotape, with student help, on-site activities of architects, soil testers, and surveyors. Then have the students present the program to the class or to a career fair.
9. Have the students do simple construction design problems, using the analysis of design and problem-solving techniques they learned.
   Transparency C2-8: Relationship of Problem Solving to the Design Process
   Transparency C2-9: Basic Elements of Design
   Transparency C2-10: Principles of Design

Transparency C2-11: New Construction Materials and Methods
Transparency C2-12: Orientation of Structure
Transparency C2-13: Areas of a House

Vocabulary Worksheet

1. negotiation
2. condemnation
3. power of eminent domain
4. abstract
5. closing
6. deed
7. zoning
8. building code
9. feasibility study
10. soil testing
11. load-bearing surface
12. shoring
13. soil analysis
14. water table
15. test pits
16. design process

17. problem solving

18. traffic flow

19. design factors

20. surveying

21. land survey

22. topographic survey

23. route survey

24. hydrographic survey

25. aerial survey

26. construction survey

27. horizontal control

28. vertical control

29. transit

30. level

31. benchmark

32. contour map

33. topographic map

TEST

Unit 2: Preconstruction

Directions: Read each statement carefully. Select the word or phrase that correctly answers or completes the statement, and write the appropriate letter in the blank.

Example: __B__ 21. The class that you are in is—
A. Health
B. Industrial Arts
C. Art
D. Choir

___ 1. When the owner and buyer discuss the property and agree upon the selling price and the terms of settlement, this is known as—
A. negotiation
B. condemnation
C. encroachment
D. easement

___ 2. The process used on many government and public projects when the owner refuses to sell the land is—
A. negotiation
B. condemnation
C. encroachment
D. easement

___ 3. The type of survey used to determine the terrain of the site is a—
A. land survey
B. route survey
C. construction survey
D. topographic survey

___ 4. The known point on the earth's surface in a survey is the—
A. benchmark
B. horizontal control
C. vertical control
D. monument

___ 5. The surveying instrument that measures both horizontal and vertical angles is—
A. level
B. chain
C. rod
D. transit

___ 6. The map that shows changes in the height and shape of the site is a—
A. topographic map
B. road map
C. contour map
D. land map

___ 7. The process used to properly locate a structure on a site is—
A. plotting
B. orientation
C. siting
D. benchmarking

___ 8. The kitchen should be located on the _________ side of the house.
A. east
B. south
C. north
D. west

___ 9. The principle that gives the government the right to obtain property for public use, through a fair settlement to the owner, is—
A. negotiation
B. power of eminent domain
C. easement
D. condemnation

___ 10. The type of survey used to survey large tracts of land is—
A. aerial survey
B. topographic survey
C. hydrographic survey
D. route survey

SELECTING THE SITE

GOOD LOCATION

AVAILABLE

STRUCTURE WILL LOOK GOOD ON IT

USEFUL

AFFORDABLE

CRITERIA FOR SELECTING A SITE

GOOD COMMUNITY ENVIRONMENT

AVAILABLE UTILITIES

GOOD TRANSPORTATION

ADEQUATE SUPPLY OF LABOR

USEFUL SITE

MARKET FOR PRODUCT

ZONED PROPERLY

SUITABLE CLIMATE

DIFFERENCE BETWEEN NEGOTIATION AND CONDEMNATION

NEGOTIATION: THE OWNER AND BUYER DISCUSS THE PROPERTY AND AGREE UPON THE SELLING PRICE AND TERMS OF THE SETTLEMENT.

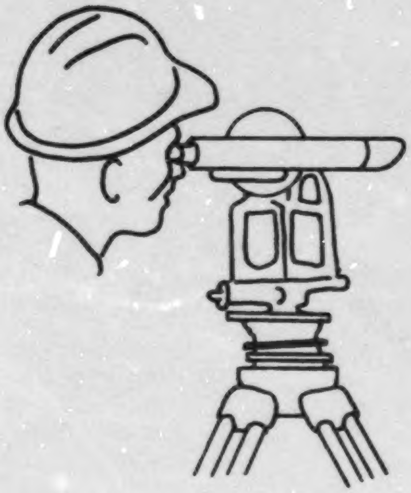
CONDEMNATION: IS USED ON MANY GOVERNMENT AND PUBLIC PROJECTS WHEN THE OWNER REFUSES TO SELL THE PROPERTY. THROUGH THE POWER OF EMINENT DOMAIN.

TYPES OF SURVEYS

TOPOGRAPHIC

HYDROGRAPHIC

LAND

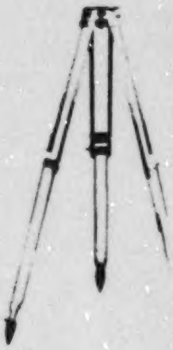


ROUTE

AERIAL

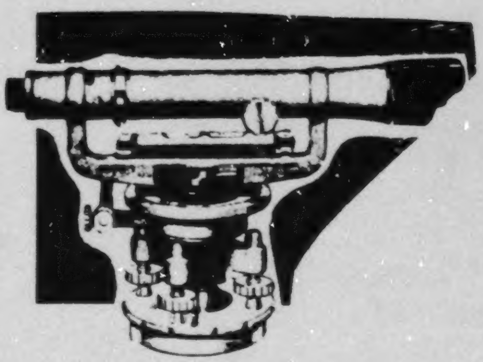
CONSTRUCTION

SURVEYING EQUIPMENT



WIDE FRAME TRIPOD

RODS AND TARGETS

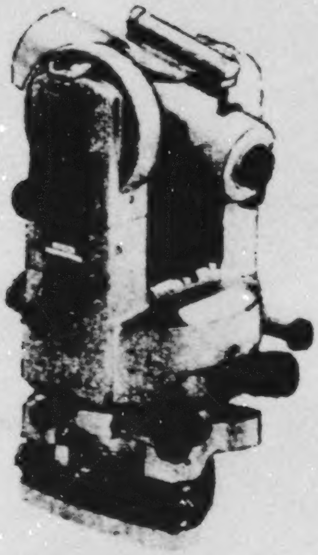


UNIVERSAL LEVEL

(V) 185° 36' 20"
(H) 283° 56' 20"

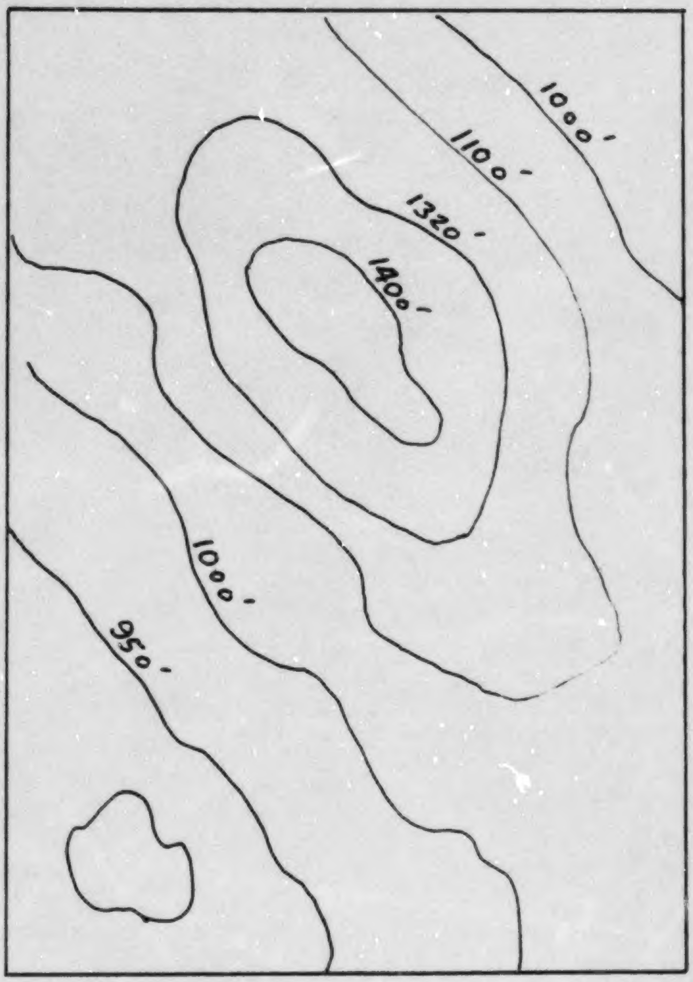
MICROMETER THEODOLITE

- 30 X magnification resolves to 3" for bright, sharp target images.
- Optical plummet is located in alidade and rotates with instrument for precise operation and performance reliability.

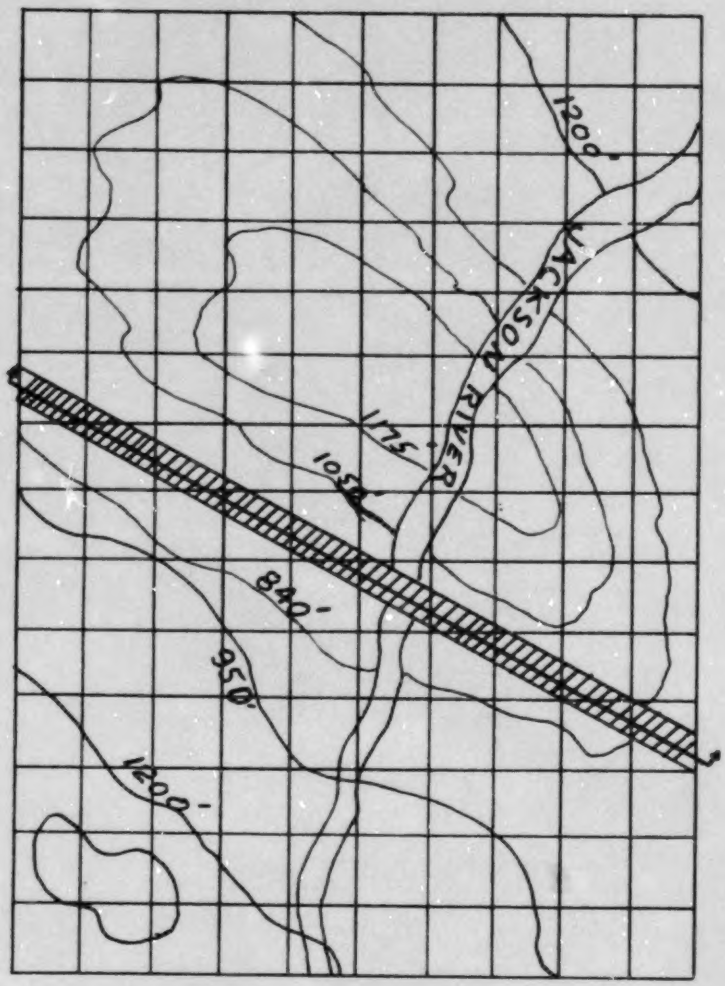


TRANSIT

CONTOUR MAP


1000'
1100'
1320'
1400'
1000'
950'

TOPOGRAPHIC MAP


1200'
JACKSON RIVER
1175
1050'
840'
950'
1200'

RELATIONSHIP OF PROBLEM SOLVING TO THE DESIGN PROCESS

IDENTIFYING THE DESIGN PROBLEM

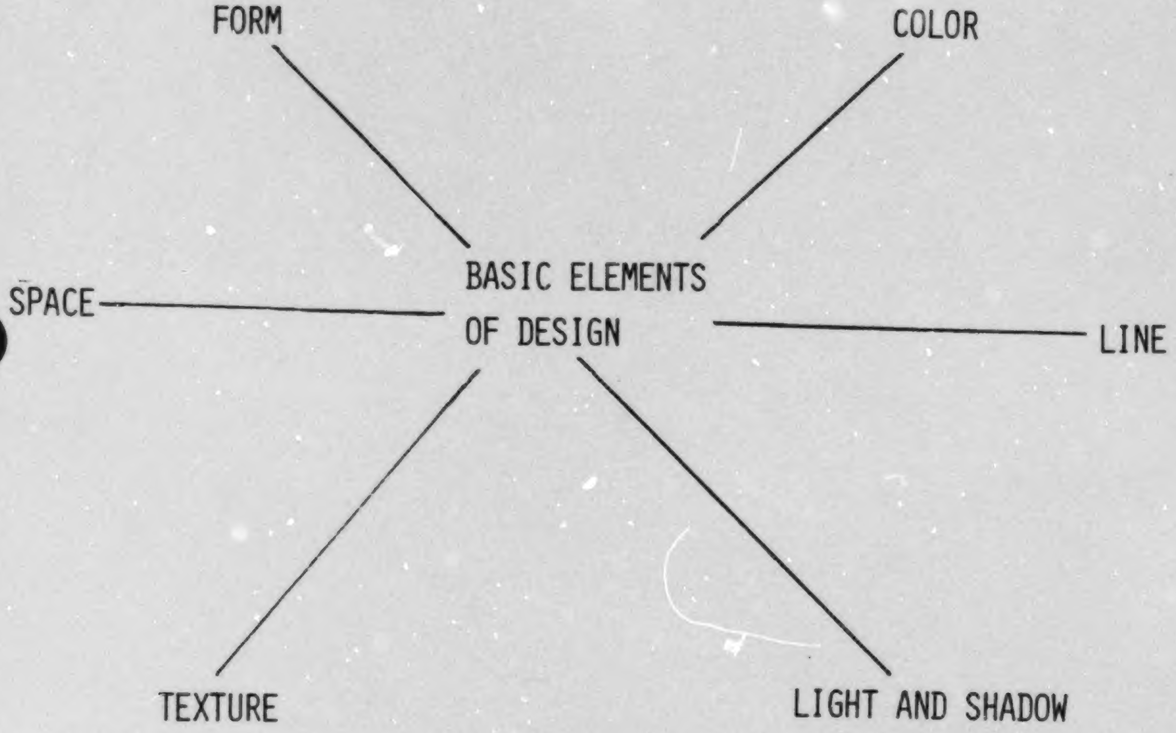
CREATING PRELIMINARY IDEAS

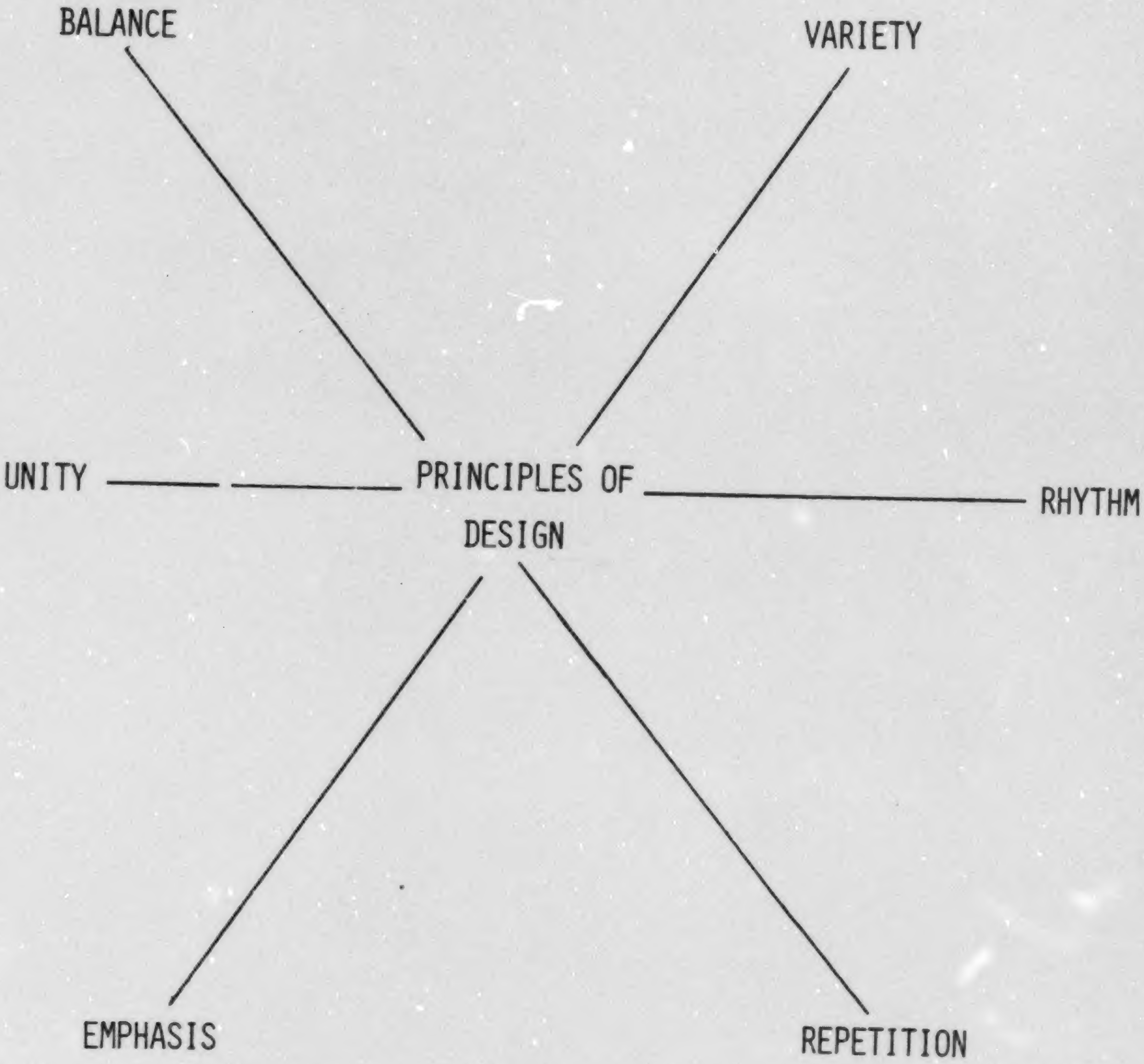
REFINING IDEAS

ANALYZING IDEAS

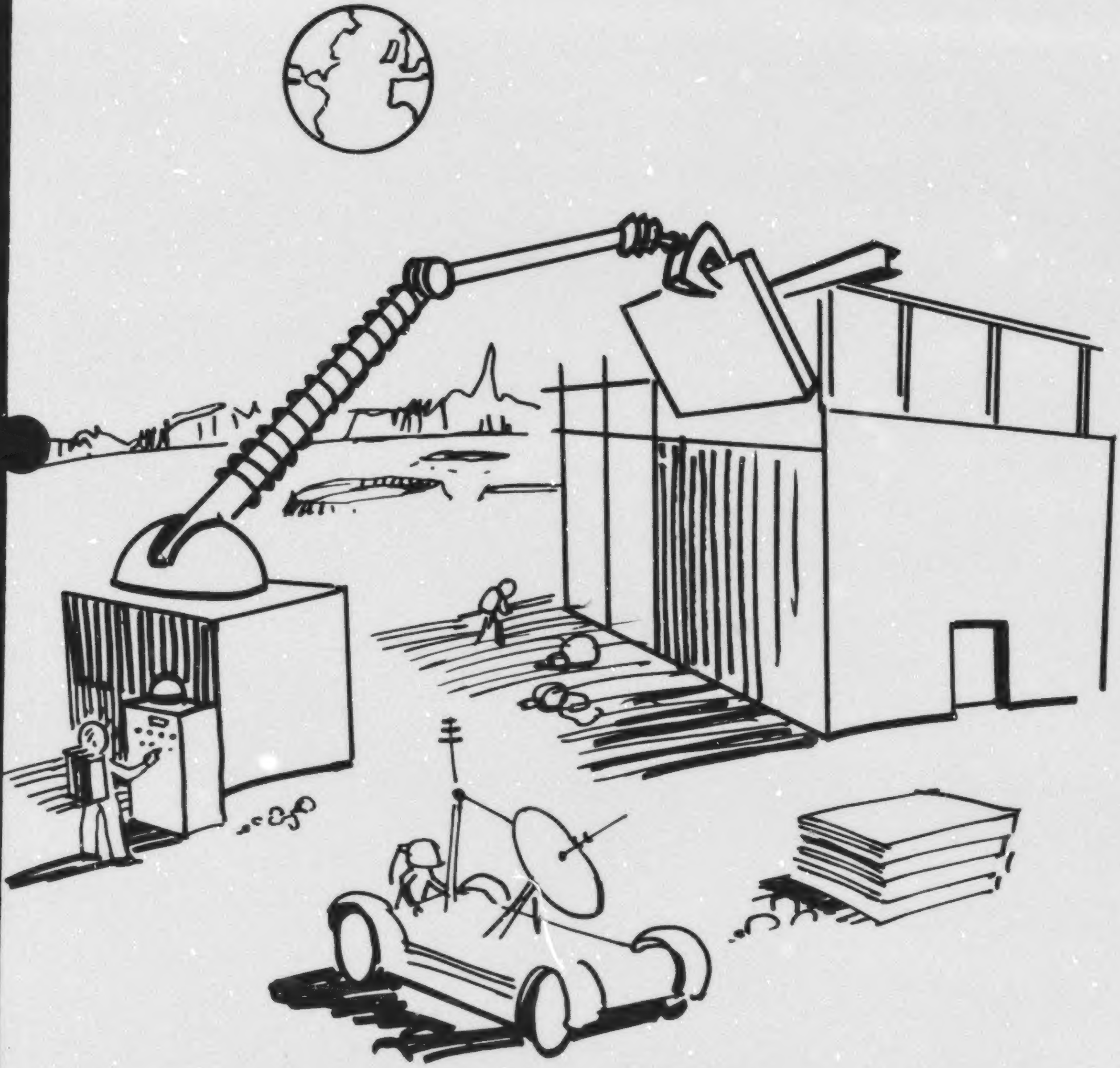
SELECTING THE DESIGN

IMPLEMENTING THE DESIGN


FORM
COLOR
SPACE
BASIC ELEMENTS OF DESIGN
LINE
TEXTURE
LIGHT AND SHADOW


BALANCE
VARIETY
UNITY
PRINCIPLES OF DESIGN
RHYTHM
EMPHASIS
REPETITION

NEW CONSTRUCTION MATERIALS & TECHNIQUES



ORIENTATION OF STRUCTURE

Orientation*

1. Sun exposure very brief, if any.
2. Little sunshading needed.
3. Overhang can be minimum.

1. Sun exposure is short and intensity is partly relieved by cool air.
2. Overhang and reflective screens ineffective.
3. Low trees or hill give valuable shade.

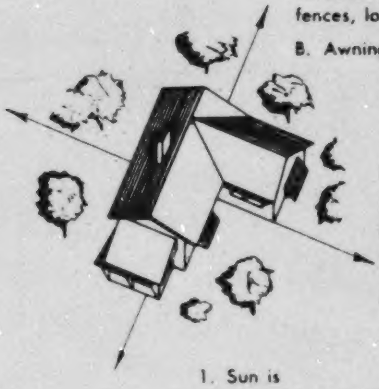
Solutions (in order of effectiveness)

A. Sunshading by walls, trellis, lattice, high fences, low trees, etc.
B. Awnings.

1. Sun exposure is short but intensified by high air temperature and low angle.

Solutions (in order of effectiveness)

A. Sunshading by walls, trellis, lattice, high fences, low trees, etc.
B. Porch or veranda.
C. Attached carport or garage.
D. Awnings.
E. Minimum Glass Area.



1. Sun exposure is sustained and intense.
2. Both tall and medium trees are needed for shade.

Solutions (in order of effectiveness)

A. Porch or veranda.
B. Awnings.
C. Reflective screens.
D. Recommended overhang.

1. Sun exposure is sustained and intensified by day's hottest air.
2. Both tall and medium trees needed for shade.

Solutions (in order of effectiveness)

A. Attached carport or garage.
B. Porch or veranda.
C. Glass area fully shaded.
D. Storage cabinets in wall.
E. Awnings or reflective screening.
F. Avoid slab reflecting heat against wall.

1. Sun is almost overhead and wall absorption is moderate.
2. Exposure is sustained and intense.

Solutions (in order of effectiveness)

A. Recommended overhang.
B. Reflective screens.
C. Large glass area (if used) under recommended overhang.
D. Awnings.
E. Avoid slabs reflecting heat against wall.

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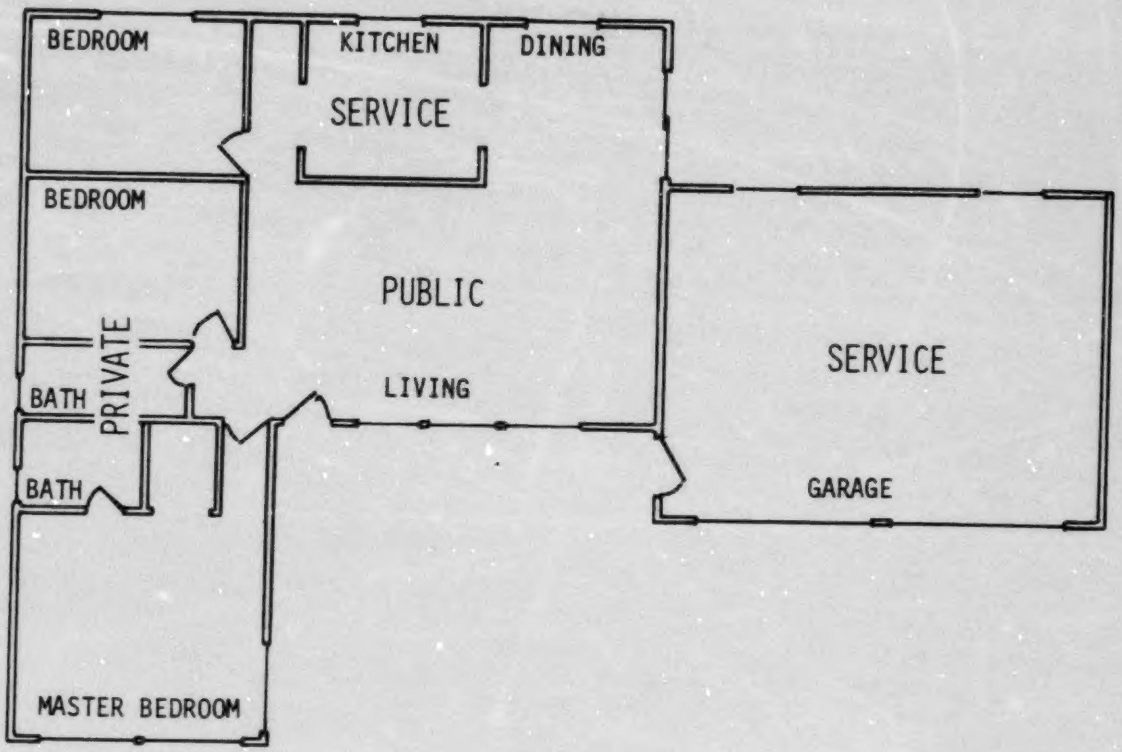
*Reprinted from National Association of Home Builders' Research Institute publication entitled Residential Air Conditioning-A Summary Report of the Austin Air-Conditioned Village Project

AREAS OF A HOUSE


BEDROOM
KITCHEN
DINING
SERVICE
BEDROOM
PUBLIC
PRIVATE
SERVICE
BATH
LIVING
BATH
GARAGE
MASTER BEDROOM

3

Personnel Management

OBJECTIVES

After the students have covered the material in this unit, they should be able to—

1. understand how to apply for a job and know how to fill out a job application form;
2. demonstrate the key factors regarding interviewing for a job;
3. understand how the construction industry hires, advances, trains, retrains, demotes, and retires workers;
4. understand what careers are available in the construction industry; and
5. relate the relationship, duties, and responsibilities of youth leadership as a function of personnel management.

KEY WORDS: VOCABULARY

The words in the following list may be new to the students studying construction. Teachers should help students understand these words as they are used in this topic of study.

personnel system
decision making
vendor
enterprise
organize
manage
technical
professional worker
technical worker
skilled worker
nonskilled worker
semiskilled worker
industrial community resources
hiring
training
advancing
retraining
demoting
retiring
career

TEACHING AIDS

- Overhead projector
- Appendices A and B
- Test Key: 1-C, 2-A, 3-B, 4-D, 5-B, 6-A, 7-D, 8-C, 9-A, 10-D
- Transparencies: You will find transparencies C3-1 through C3-19 at the end of this unit. If you wish, these masters may be duplicated in quantity and given as handouts to the students while they are studying the different aspects of this unit.

C3-1: How to Apply for a Job
C3-2: Job Application Form
C3-3: Interviewing for a Job
C3-4: Reasons for Hiring an Applicant
C3-5: Format for Collecting Career Information
C3-6: Field Trip Observation Form
C3-7: Entry-Level Employment Requirements
C3-8: Resource Person Information Sheet
C3-9: The Student Association as Personnel System with Uniform Titles
C3-10: AIASA Personnel In-Class Duties
C3-11: Committee Duties
C3-12: Organizational Structure

C3-13: In-Class Meeting Procedures
C3-14 A&B: How Motions are Made
C3-15: Duties for In-Class Use of Community Resources
C3-16: Duties for In-Class Service Projects
C3-17: Duties for In-Class Enterprising Products
C3-18: Duties for In-Class Contests or Recognition
C3-19: Regional, State, and National Recognition Events for Industrial Arts Students

SUGGESTED REFERENCES

Achievement Program. Reston, Va.: American Industrial Arts Association, 1983.

AIASA Guide for Industrial Arts Program Standards for Industrial Arts Programs. Blacksburg, Va.: Virginia Polytechnic Institute and State University, November, 1981.

Barnes, James L. "American Industrial Arts Student Association Student Record Book." Unpublished research, Virginia Polytechnic Institute and State University, 1983.

Betts, M. Roger; Hausenstein, A. Dean; and Fannin, John. *Exploring the Construction Industry*. Bloomington, Ill.: McKnight Publishing Company, 1976.

Guide II: Student Association Activities in Industrial Arts Instruction. Richmond, Va.: Department of Education, 1979.

Landers, Jack M. *Construction Materials, Methods, Careers*. South Holland, Ill.: Goodheart-Willcox Company, 1983.

Lux, Donald G.; Ray, Willis E.; Blankenbaker, E. Keith; and Umstattd, William. *World of Construction*. Bloomington, Ill.: McKnight Publishing Company, 1982.

Texas Industrial Arts Student Association. Austin, Tex.: Texas Education Agency, 1975.

Texas Industrial Arts Student Association 1983 Handbook Regional and State Competition. Austin, Tex.: Texas Education Agency, 1983.

U. S. Department of Labor. *Dictionary of Occupational Titles*. U. S. Department of Labor, 1977.

Willcox, George R. "AIASA: As a Teaching Tool." Paper presented at the meeting of the American Industrial Arts Association, Pittsburgh, Penn., March 23, 1981.

SENTENCE OUTLINE

I. Applying for a Job (Transparency C3-1)
   A. Knowing how to look for a job and apply for it are crucial to finding the right job for you.
   B. Several good sources for finding job possibilities are:
      1. public employment commissions
      2. private employment agencies
      3. education and manpower schools/facilities
      4. newspapers, magazines, government publications, and so on
      5. word of mouth
   C. After you locate several job possibilities, you need to make proper application for each job in which you are interested. (Transparency C3-2)
      1. Job application forms can be obtained and filled out at the employment agency or at the construction company's office.
      2. It is crucial to your success in obtaining an interview for the job that you read the job application form carefully before you start filling out the form. Be sure to follow the directions explicitly.
   D. Being prepared for the interview is a key to success in obtaining the job. (Transparency C3-3)
      1. Your appearance should be neat.
      2. You should have a positive attitude.
      3. You should arrive at the interview approximately fifteen (15) minutes before your interview is scheduled.

4. You should be polite, courteous, and honest during the interview.
5. You should be enthused about the job for which you are applying.
6. You need to communicate well with the interviewer.

II. Understanding how the construction industry hires, trains, advances, retrains, demotes, and retires workers

A. There are many reasons for hiring one applicant over another. Among these are: (Transparency C3-4)
   1. previous work experience
   2. interest in the specific job
   3. recommendations from previous employers
   4. training background
   5. personal appearance
   6. manners and mannerisms
   7. personality
   8. ambition
   9. maturity
   10. educational background

B. Through training programs, workers can advance in the company's structure.

C. Because of changes in technology and business conditions, many construction companies are now retraining their employees to keep up with these changes.

D. Being demoted or fired from a job could affect your possibilities for future employment. The four basic reasons that workers get demoted or fired are:
   1. absenteeism
   2. not qualified to perform tasks
   3. continually make costly mistakes
   4. do not follow instructions and lack interest in job

E. Retiring from a job after many years of job satisfaction is very rewarding. Through many construction companies, you will receive a company pension, based on the number of years of service.

III. Careers in the construction industry

A. Most people work an average of 25 to 45 years, an important part of one's life. Jobs are growing increasingly specialized in almost every field, including the construction industry. New technologies are creating a demand for highly skilled men and women. As a result, employers are putting a premium on specific skills. Career planning is becoming essential. Now is the time to start looking at the various options and directions a student may want to pursue.

B. The first step in choosing a career is to consider the vast array of careers in existence today. We will look at the various opportunities in the construction field. (Transparency C3-5 and C3-6)

C. Following are the basic classifications of workers:
   1. professional
   2. technical
   3. skilled
   4. semiskilled
   5. nonskilled

D. A look at the various occupational levels will help you understand the specific occupations discussed later. (Transparency C3-7 and C3-8)
   1. **Professional workers.** A college education is required, or four or more years of formal education beyond the high school level. Architects, engineers, researchers, teachers, high-level managers and most executives are among these.
   2. **Technical workers.** Some college and technical training is required, but not necessarily a college degree. Drafters, engineering assistants, and technicians are among these.

   3. **Skilled workers.** Lengthy preparation through on-the-job training or through apprenticeship programs is required. Carpenters, plumbers, electricians, and roofers are among these.
   4. **Semiskilled workers.** Considerable on-the-job training is required. Generally, these persons are machine operators and are employed in every major industry.
   5. **Nonskilled workers.** Little on-the-job training is required. Workers such as helpers and laborers fall into this occupational category.
- E. Examples of professional workers in the construction industry
   1. Architects design structures and are involved in all phases of the project development. They are responsible for the complete set of working drawings and writing the detail specifications for the project. Their job requires the skills of design, managing, supervising, and engineering.
   2. Interior designers create more attractive living, working, and playing areas in homes and buildings. They analyze the overall needs of the project, prepare detail sketches and plans, and oversee the work to the finished product.
- F. Examples of technical workers in the construction industry
   1. Drafters prepare working drawings of residential, commercial, and civil construction projects. They also calculate cost of materials, strength, quality, and quantity of materials.
   2. Mechanical researchers set up and operate equipment to test structural materials according to standards. These tests are designed to discover faults in design and fabrication.
- G. Examples of skilled workers in the construction industry
   1. Masons work to create beautiful structures from brick and stone materials. Their work may include bricking a home or building, constructing a stone wall, or laying a patio or marble hearth.
   2. Carpenters are responsible for constructing homes, commercial buildings, and bridges. They work with wood, metal, plastic, glass, and many other construction materials. Carpenters are usually divided into two categories. These are "rough" and "finished" carpenters. Rough carpenters are responsible for rough framing of structures, while finished carpenters are responsible for the trim work, cabinetwork, and millwork.
- H. Examples of semiskilled workers in the construction industry
   1. Apprenticeship workers who assist plumbers, electricians, or roofers
   2. An operator of machinery or equipment that does not require lengthy preparation or completion of an apprenticeship program
- I. Examples of nonskilled workers in the construction industry are laborers who might assist skilled workers on the job

IV. Youth leadership

- A. Using personnel/leadership development systems
   1. All organizations use systems to manage group activities. (Transparency C3-9)
   2. Personnel who hold various positions and duties in the system rely on the total group working together for the benefit of all in the organization. (Transparency C3-10)
   3. The personnel system is made up of officers and committees that are responsible for carrying out the duties and responsibilities of the organization. (Transparency C3-11 and C3-12)
   4. It is important for students to work together and to develop leadership skills.
   5. Democratic decision making is developed through the process of conducting meetings and learning how to make motions in these meetings. (Transparency C3-13 and C3-14)
- B. Using industrial community resources
   1. Making contacts with community and industrial leaders helps develop leadership skills.

2. Part of leadership development is learning how to survey industry and to use a questionnaire during an interview.
3. Community resources are extensions of the industrial arts classroom that allow students a more in-depth exposure to personnel/leadership development.

C. Providing a school or community service (Transparency C3-16)
1. Service or community projects provide benefits to others and to those who provide them.
2. Service projects enable students to use their technical knowledge to help others in the same way that inventions help solve problems.

D. Selling a product or service (Transparency C3-17)
1. In the United States, the industrial system is called free enterprise. This means that we are free to establish almost any kind of business and to make almost any product we desire.
2. Through free enterprise, companies are encouraged to produce new products that are protected by patents.
3. Products are sold for their economic value, and services are provided for their economic value.

E. Recognizing student achievement (Transparency C3-18)
1. AIASA contests and booth exhibits provide opportunities for students to develop leadership skills through competing and interacting with other students on regional, state, and national levels. (Transparency C3-19)
2. Through the various contests and exhibits, students will be recognized for outstanding individual and chapter work.

MATERIALS FOR STUDENTS

- Vocabulary worksheet
- Format for collecting career information
- Student activities
- Field trip observation form
- Entry-level employment requirements
- AIASA materials
- Job application form

SUGGESTED STUDENT ACTIVITIES

1. Have students determine which local companies employ the various occupations in the construction industry.
2. Have students conduct research on new jobs that have been created through recent technological advances.
3. Invite an individual or panel of resource persons to discuss the types of work done in their jobs in the construction industry. If arrangements cannot be made to have resource person(s) visit your class, videotape these people on-site.
4. Investigate the instruments, tools, and equipment needed by a person who is starting in the various technical and skilled jobs.
5. Discuss safety in relationship to the various occupations, which jobs might be hazardous, and other safety issues.
6. Take a field trip to a construction site and observe the employees at work.
7. View training films or other visuals available on careers in the construction industry.
8. Have a personnel director or recruiter talk to your class or videotape the presentation to show to the class.
9. Videotape on-site activities of architects, engineers, carpenters, or plumbers for use in showing on-site career information.

10. Conduct a survey in the various occupations to determine the male/female employee ratio. Also try to determine the trends in the increasing roles and responsibilities of employees in the construction industry.
11. Have students select occupations that interest them. Fill out career information forms using various references.
12. Invite a resource person from OSHA to present information on health and safety as they relate to "construction" occupations.
13. Have students organize a construction company to produce a product or service. Have students apply for a job in the company, fill out job application forms, and interview for those positions. Videotape the interviews so students can see how well they did during the interview. You can use your principal, vocational administrator, or a personnel director from a local business to interview the students.
14. Students will participate in a discussion of the various positions in the Personnel/Leadership System. After election to office or committee position, they will practice the duties. Their duties will help them conduct class meetings and manage laboratory activities. During class meetings, the students will use parliamentary procedures to make democratic decisions.
15. All students will study the handouts describing the personnel system used in the class.
16. A nominating committee will be formed to work with the teacher and prepare ballot.
17. Students elected to office and committee positions will study duties and learn how to conduct a meeting.
18. Parliamentary procedures will be learned so that motions are used by all students.
19. Class officers will conduct a meeting to determine which industrial and community resources will be used to learn a certain unit of industrial arts. A community resource committee will meet to list and select appropriate speakers or industrial tours. The class will vote on the best resource.

    With the help of the teachers and the principal, the speaker is called or a letter is written. If all students are not permitted to visit the industry, the committee may visit, videotape the industry, and report to the class. Afterwards, a "Thank you" letter should be written to the persons who assisted the class or committee.
20. Class officers: Conduct a meeting wherein the teacher will give a lesson on Using Community Resources. A historian serves on the committee. After the committee selects the appropriate resources, the officers will conduct a meeting to select one. The officers will announce when the next class meeting will be held to allow time for this activity.
21. Committee members: (1) Use the library, Chamber of Commerce Directories, or the Yellow pages to find a business or industry related to the unit of study. (2) After the class votes on the best resource, the committee writes a letter to invite a speaker or arrange a tour. (3) The parliamentarian obtains permission forms from the principal's office, if required. (4) A follow-up is made to check on arrangements. (5) If the class is not permitted to visit the industry, the committee may visit and videotape the tour for the class. (6) A "Thank you" letter is written to the speaker or industry. (7) Records are kept in a file for use by other classes or school chapters.
22. Class officers will conduct a class meeting to decide which service project will be provided by the class to help the school or community. A service committee will organize the project and involve class members in laboratory work to complete the project for delivery or pickup.
23. Class officers will conduct a meeting to decide which product or service will be of economic value to the class or AIASA. The class will work as a group to form the enterprise. An enterprising committee will organize technical and financial details for the class members. the entire class will work to make a profit for the class or to pay for AIASA dues or other activities.
24. Class officers will conduct a meeting to decide which contests will provide recognition to students who achieve. A recognition committee will organize

contests, exhibits, or demonstrations for the class. Class members will compete with each other or work together on a recognition event, such as open house.

Vocabulary Worksheet

1. personnel system
2. decision making
3. vendor
4. enterprise
5. organize
6. manage
7. technical
8. professional worker
9. technical worker
10. skilled worker
11. nonskilled worker
12. semiskilled worker
13. industrial community resources
14. hiring
15. training
16. advancing

17. retraining

18. demoting

19. retiring

20. career

TEST

Unit 3: Personnel Management

Directions: Read each statement carefully. Select the word or phrase that correctly answers or completes the statement, and write the appropriate letter in the blank.

Example: __D__ 21. The class that you are in is—
A. Health
B. Science
C. Art
D. Industrial Arts

___ 1. Most people work a average of—
A. 5 to 10 years
B. 10 to 20 years
C. 25 to 45 years
D. 45 to 70 years

___ 2. The first step in choosing a career is to—
A. consider the vast variety of careers that exist
B. get information about worker's compensation
C. get advanced degrees
D. go out and get a job

___ 3. The highest occupational level is—
A. technical
B. professional
C. skilled
D. semiskilled

___ 4. Which of the following reasons led to workers being demoted or fired?
A. following instructions
B. being interested in the job
C. working overtime
D. absenteeism

___ 5. The lowest level of the occupational ladder is—
A. professional
B. nonskilled
C. skilled
D. semiskilled

___ 6. Being a skilled worker requires—
A. lengthy preparation through on-the-job training
B. an advanced degree
C. a college degree
D. no experience

___ 7. Semiskilled workers require—
A. no experience
B. little or no experience
C. little or no preparation
D. considerable preparation through on-the-job training

___ 8. Technical workers require—
A. a college degree
B. lengthy on-the-job training
C. some college and/or technical training
D. little or no experience

___ 9. The industrial system in the United States is called—
A. free enterprise
B. capitalism
C. communism
D. barter

___ 10. Construction occupations include—
A. architects
B. engineers
C. carpenters
D. all of the above

HOW TO APPLY FOR A JOB

SOURCES OF JOBS

1. PUBLIC EMPLOYMENT COMMISSIONS
2. PRIVATE EMPLOYMENT AGENCIES
3. EDUCATION AND MANPOWER SCHOOLS/FACILITIES
4. NEWSPAPERS, MAGAZINES, GOVERNMENT PUBLICATIONS, ETC.
5. WORD OF MOUTH

LETTER OF APPLICATION

1. A NEAT, LEGIBLE LETTER OF APPLICATION SHOWS ORGANIZATION AND CONCISENESS ON YOUR PART.
2. INCLUDE DETAILS THAT WOULD BE OF INTEREST TO A PROSPECTIVE EMPLOYER.
3. YOUR LETTER SHOULD BE SO CONVINCING THAT THE EMPLOYER WILL WANT TO TALK TO YOU PERSONALLY.

APPLICATION FORM

1. HAVE BACKGROUND INFORMATION AND DATES AVAILABLE WHEN YOU FILL OUT AN APPLICATION FORM AT ANY PLACE OF BUSINESS.
2. ALWAYS FILL OUT ALL BLANKS ON AN APPLICATION FORM.
3. FOLLOW ALL DIRECTIONS WHEN FILLING OUT AN APPLICATION FORM.

APPLICATION FOR EMPLOYMENT

OFFICE OF PERSONNEL SERVICES
AND EMPLOYEE RELATIONS
2613 Wichita St. P. O. Drawer V
Austin, Texas 78712-7449 (512) 471-3656

IMPORTANT INSTRUCTIONS: (1) Print all information using a #2 pencil. (2) Answer *all* questions completely. (3) A resume will not substitute for this application.

DATE

WHEN COULD YOU START WORK?

FULL-TIME ☐ PART-TIME ☐

LOWEST MONTHLY SALARY YOU WOULD ACCEPT

ARE YOU SEEKING TEMPORARY EMPLOYMENT? YES ☐ NO ☐
IF YES, HOW LONG? ________

PRINT NAME LAST FIRST MIDDLE

SOCIAL SECURITY NUMBER

PRESENT ADDRESS STREET & NUMBER CITY STATE ZIP CODE

TELEPHONE NUMBER Home Office

IF YOUR AGE IS BELOW 18 YEARS, OR IS 70 YEARS OR ABOVE, GIVE DATE OF BIRTH

MALE ☐ FEMALE ☐

ARE YOU A UNITED STATES CITIZEN? YES ☐ NO ☐

HAVE YOU EVER BEEN EMPLOYED WITH THE UNIVERSITY OF TEXAS AT AUSTIN? YES ☐ NO ☐

IF YES, WHEN? ________

HAVE YOU EVER RECEIVED WORKERS' COMPENSATION PAYMENTS FOR WORK RELATED INJURIES? YES ☐ NO ☐

IF YES, GIVE DATE OF INJURY AND THE EMPLOYER'S NAME AND ADDRESS ________

ARE YOU RELATED BY KINSHIP OR MARRIAGE TO ANY CURRENT EMPLOYEE OR TO ANY MEMBER OF THE BOARD OF REGENTS OF THE UNIVERSITY OF TEXAS SYSTEM? YES ☐ NO ☐

IF YES, GIVE NAME AND RELATIONSHIP ________

HAVE YOU EVER BEEN CONVICTED OF A VIOLATION OF ANY LOCAL, STATE, OR FEDERAL LAW (OTHER THAN MINOR TRAFFIC VIOLATIONS)? YES ☐ NO ☐

IF YES, GIVE DATE(S) AND NATURE OF CONVICTION(S). ________

HOW WERE YOU REFERRED TO THIS OFFICE?
SELF ☐ FRIEND ☐ U.T. EMPLOYEE ☐ T.E.C. ☐
ADVERTISEMENT ☐ OTHER ☐: SPECIFY ________

EDUCATION—Circle the total number of years of education that you have completed (elementary through college):

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

Check if you have a GED ⟶ ☐

NAME AND LOCATION OF SCHOOL	FROM Month & Year	TO Month & Year	DID YOU GRADUATE?	HOURS OF CREDIT	TYPE OF DEGREE	MAJOR	SEMESTER HOURS OF CREDIT IN MAJOR
HIGH SCHOOL							
COLLEGE OR UNIVERSITY							
OTHER FORMAL TRAINING							

DO YOU HAVE A CURRENT DRIVER'S LICENSE? YES ☐ NO ☐

IF YES, WHAT KIND? CHAUFFEUR ☐ COMMERCIAL ☐ OPERATOR ☐ WHAT STATE? ________

LIST OTHER LICENSES, CERTIFICATIONS, OR REGISTRATIONS (PROFESSIONAL, TECHNICAL, OR OTHERWISE) WHICH YOU POSSESS

LIST THE LANGUAGES, BESIDES ENGLISH, WHICH YOU SPEAK, READ, OR WRITE, AND YOUR FLUENCY IN EACH LANGUAGE

FOR PERSONNEL OFFICE USE ONLY

SPELLING ________ ( ) TYPING ________ ( ) SHORTHAND ________ ( )

BEST COPY AVAILABLE

EXPERIENCE — Start with your present or last position and work back. List *all* work experience including U.T. experience and military experience. Be specific when listing your job duties.

List any other names under which you have been employed:

NAME OF EMPLOYER	STREET ADDRESS	CITY AND STATE	TELEPHONE
NAME AND TITLE OF IMMEDIATE SUPERVISOR		REASON FOR LEAVING	

FROM		TO	
Month	Year	Month	Year

LIST EACH JOB TITLE THAT YOU HELD, TIME SPENT AT EACH TITLE, AND JOB DUTIES AT EACH TITLE

MONTHLY SALARY
START $ END $

AVERAGE NUMBER OF HOURS YOU WORKED EACH WEEK

HOW MANY DID YOU SUPERVISE, IF ANY?

NAME OF EMPLOYER	STREET ADDRESS	CITY AND STATE	TELEPHONE
NAME AND TITLE OF IMMEDIATE SUPERVISOR		REASON FOR LEAVING	

FROM		TO	
Month	Year	Month	Year

LIST EACH JOB TITLE THAT YOU HELD, TIME SPENT AT EACH TITLE, AND JOB DUTIES AT EACH TITLE

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NAME AND TITLE OF IMMEDIATE SUPERVISOR		REASON FOR LEAVING	

FROM		TO	
Month	Year	Month	Year

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MONTHLY SALARY
START $ END $

AVERAGE NUMBER OF HOURS YOU WORKED EACH WEEK

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NAME OF EMPLOYER	STREET ADDRESS	CITY AND STATE	TELEPHONE
NAME AND TITLE OF IMMEDIATE SUPERVISOR		REASON FOR LEAVING	

FROM		TO	
Month	Year	Month	Year

LIST EACH JOB TITLE THAT YOU HELD, TIME SPENT AT EACH TITLE, AND JOB DUTIES AT EACH TITLE

MONTHLY SALARY
START $ END $

AVERAGE NUMBER OF HOURS YOU WORKED EACH WEEK

HOW MANY DID YOU SUPERVISE, IF ANY?

ASK FOR AN ADDITIONAL SHEET IF YOU NEED TO LIST OTHER JOBS THAT YOU HAVE HELD.

I certify that the statements made by me in this application are true, complete, and correct to the best of my knowledge and belief and are made in good faith. I understand that any false statements made herein will void this application and any actions based on it. I understand that any offer of employment rendered me is contingent upon my agreement to abide by the rules and regulations of the Board of Regents of the University of Texas System.

SIGNATURE OF APPLICANT ______________________ DATE ______________

BEST COPY AVAILABLE

INTERVIEWING FOR A JOB

1. YOUR APPEARANCE SHOULD BE NEAT.
2. YOU SHOULD HAVE A POSITIVE ATTITUDE.
3. YOU SHOULD ARRIVE AT THE INTERVIEW APPROXIMATELY 15 MINUTES BEFORE YOUR INTERVIEW IS SCHEDULED.
4. YOU SHOULD BE POLITE, COURTEOUS, AND HONEST DURING THE INTERVIEW.
5. YOU SHOULD BE ENTHUSED ABOUT THE JOB FOR WHICH YOU ARE APPLYING.
6. YOU NEED TO COMMUNICATE WELL WITH THE INTERVIEWER.

REASONS FOR HIRING AN APPLICANT

1. PREVIOUS WORK EXPERIENCE
2. INTEREST IN THE SPECIFIC JOB
3. RECOMMENDATIONS FROM PREVIOUS EMPLOYERS
4. TRAINING BACKGROUND
5. PERSONAL APPEARANCE
6. MANNERS AND MANNERISMS
7. PERSONALITY
8. AMBITION
9. MATURITY
10. EDUCATIONAL BACKGROUND

Format for Collecting Career Information

Most people work an average of 25 to 45 years – an important part of one's life. Jobs are growing increasingly specialized in almost every field. New technologies are creating a demand for highly skilled men and women. As a result, employers are putting a premium on specific skills. Career planning is becoming essential.

The first step in choosing a career is to consider the vast variety of careers in existence today. The student should talk to the teacher about career possibilities, then collect information about a possible career choice using the following suggested points:

1. What is my interest? (career to be studied)
2. What is the beginning salary? (Check with employers.)
3. Is the career open for advancement? (Where does it lead?)
4. Is there a need for this career? (Get long-range projection of demand.)
5. Where are the jobs located in this career? (Are the jobs clustered in specific areas?)
6. What kind of work does a person do in this occupation? (Get work duties and environment.)
7. What level of education is needed in order to qualify for this career? (How long does it take?)

This guide could be used with the techniques of interview, bulletin boards, reports, and class discussions.

Field Trip Observation Form

STUDENT NAME ________________________________

I. **Job title** ________________________________

II. **Description of major job duties** (please list):

A. ________________________________

B. ________________________________

C. ________________________________

D. ________________________________

E. ________________________________

III. **Job characteristics.** Check those which apply to a worker in this occupation:

_____ A. able to see physical results of work
_____ B. competitive – must compete for advancement
_____ C. directs activities of others – supervisory
_____ D. helps people
_____ E. high level of responsibility
_____ F. motivates others – must have ability to influence others
_____ G. repetitious work
_____ H. requires physical stamina
_____ I. self-expression encouraged
_____ J. closely supervised by superiors
_____ K. works with technical data
_____ L. works with people
_____ M. works alone
_____ N. manual skills required

IV. **Educational requirements.** Check level required for this occupation:

_____ A. high school education desirable
_____ B. high school education required
_____ C. junior college or trade school
_____ D. four-year college – baccalaureate
_____ E. advanced degree – master's
_____ F. advanced degree – doctorate

Entry-Level Employment Requirements

1. **Name of business** ______________________________

2. **Position** ______________________________

3. To obtain entry-level employment in this position, the following skills are required or recommended:

Education and training

Personal requirements and desirable traits

Other

By ____________________ Position or Title ______________________________
Name

Resource Person Information Sheet

Resource Person: ______________________ **Date:** ____________
Occupational Area: ____________________ **Your Name:** ____________

1. List typical jobs within the occupational area:
2. Job responsibilities:
3. Working conditions:
4. Personality traits needed for occupational area:
5. Education and/or training required:
6. Advantages and disadvantages of occupational field:
7. Advancement opportunities in this occupational field:
8. Salary range (approximate starting to estimated maximum):
9. Your personal reaction to this occupational area as described by the speaker:
10. Describe your reaction to this speaker, and make recommendations for improvement:

The Student Association as Personnel System with Uniform Titles

All Industrial Arts courses benefit from a personnel system used to manage the classroom or laboratory activities of students. Personnel management is a function of any organization whether it be a class of students, corporation of employees or an association of volunteers. Most Industrial Arts personnel systems differ as to the titles of each position in the system. Using AIASA related titles in the personnel system will both manage the class, as well as, give students experience with a group organization.

Officers in a democratic organization are best selected by the members of the group. Thus, the teacher may ask the class to nominate persons for election as key management officers. Teachers using any of the titles on the left are encouraged to utilize the uniform title in the right column.

Current Title	**Should Have This Uniform Title**
General Manager Lab Supervisor Superintendent Project Director	PRESIDENT
Manager's Assistant Assistant Supervisor Co-Director Production Manager	VICE PRESIDENT
Roll Keeper Recordkeeper Letterwriter	SECRETARY
Accountant Purchasing Agent Supply Clerk Bookkeeper	TREASURER
Safety Director Attorney or Lawyer Contract Officer Permission Coordinator Inspector	PARLIAMENTARIAN
Clean-up Supervisor	SERGEANT-AT-ARMS
Public Relations Director Advertising Agent Publicity Director	REPORTER
Education Director Final Report Writer Scrapbook Manager Librarian	HISTORIAN

AIASA PERSONNEL IN-CLASS DUTIES

PRESIDENT (Students Name)

1. Leader of personnel system.
2. Calls clean-up.
3. Conducts class meetings.
4. Receives ideas and reports from the class members.
5. Suggests any possible lab improvements gained through experience.
6. Responsible for the assignment or election of new personnel.

VICE PRESIDENT (STUDENTS NAME)

1. Familiar with duties of President.
2. Substitutes for President.
3. Assists President as second level manager.
4. Helps follow-up committee work.
5. Helps other officers if absent or behind.
6. Makes organizational chart for class.

SECRETARY

1. Takes roll, makes slip of those absent for teacher.
2. Keeps Minutes of class decisions for reading at next meeting.
3. Records list of officers and committee personnel.
4. Prepares agenda for seminar or class meetings.
5. Sends letters when necessary.

TREASURER

1. Collects routine fees or AIASA dues.
2. Checks names of students who pay and writes receipt.
3. Charge students for use of supplies.
4. Helps teacher order supplies.
5. Cleans supply room.
6. Reports progresses of supply payment or purchases at meetings.
7. Serves on Enterprising Committee of class.

PARLIAMENTARIAN

1. Is responsible for general safety procedures.
2. Posts safety posters and information.
3. Files safety test records.
4. Inventories first aid supplies and notifies instructor when additional supplies are needed.
5. Reports any injuries to the instructor.
6. Helps President with motions and rules of class.
7. Serves on School/Community Service Committee of class.

SERGEANT AT ARMS

1. Oversees all clean-up personnel.
2. Makes substitutions for absent clean-up personnel.
3. Improvises and receives ideas for improving clean-up.
4. Reports to President and teacher when the clean-up is completed.
5. Prepares room for class meetings.
6. May serve as Quality Control or Union Steward.

REPORTER

1. Reports to class on the progress of activities.
2. Prepares bulletin board or displays related to class activities or school AIASA.
3. Writes articles or makes photos for school newspaper.
4. Welcomes visitors and explains classwork.
5. Cleans darkroom if available.
6. Advertises projects or services of class.
7. Serves on Recognition Committee of class.

HISTORIAN

1. Picks up homework or assignments for teacher.
2. Checks off work turned in by class members.
3. Assembles group reports.
4. Keeps notebooks, files or scrapbook up-to-date.
5. Cleans books and reference area of class during cloud
6. Photographs activities.
7. Serves on Industrial Resource Committee of class.

COMMITTEE DUTIES

LABORATORY MAINTENANCE/CLEANUP COMMITTEE

1. Sgt. at arms and officers appoint or rotate personnel to each position.
2. All students in class have duties or either as leader or worker in one of these areas:
   (1) Supplies and reference materials
   (2) Tools, equipment and machines
   (3) Auxiliary Rooms
   (4) Others (determined by teacher)
3. Workers report completion of duties to chairperson, leader, or sgt. at arms.
4. President, Sgt. at arms or teacher dismisses class at proper time.

INDUSTRIAL/COMMUNITY RESOURCE COMMITTEE

1. Make list of industrial or community resources related to course.
2. With teacher, select 3 helpful to unit of study.
3. Report resources available at class meetings for vote.
4. Arrange speakers or visits for class.
5. Send thank you letters.

SCHOOL/COMMUNITY SERVICE COMMITTEE

1. Make list of classroom, school or community service projects related to course.
2. With teacher, select 3 related to technical unit of study.
3. Review requests from others for services.
4. Report possible projects at class meetings for vote.
5. Organize class for work to be done.
6. Deliver service to appropriate person or group.

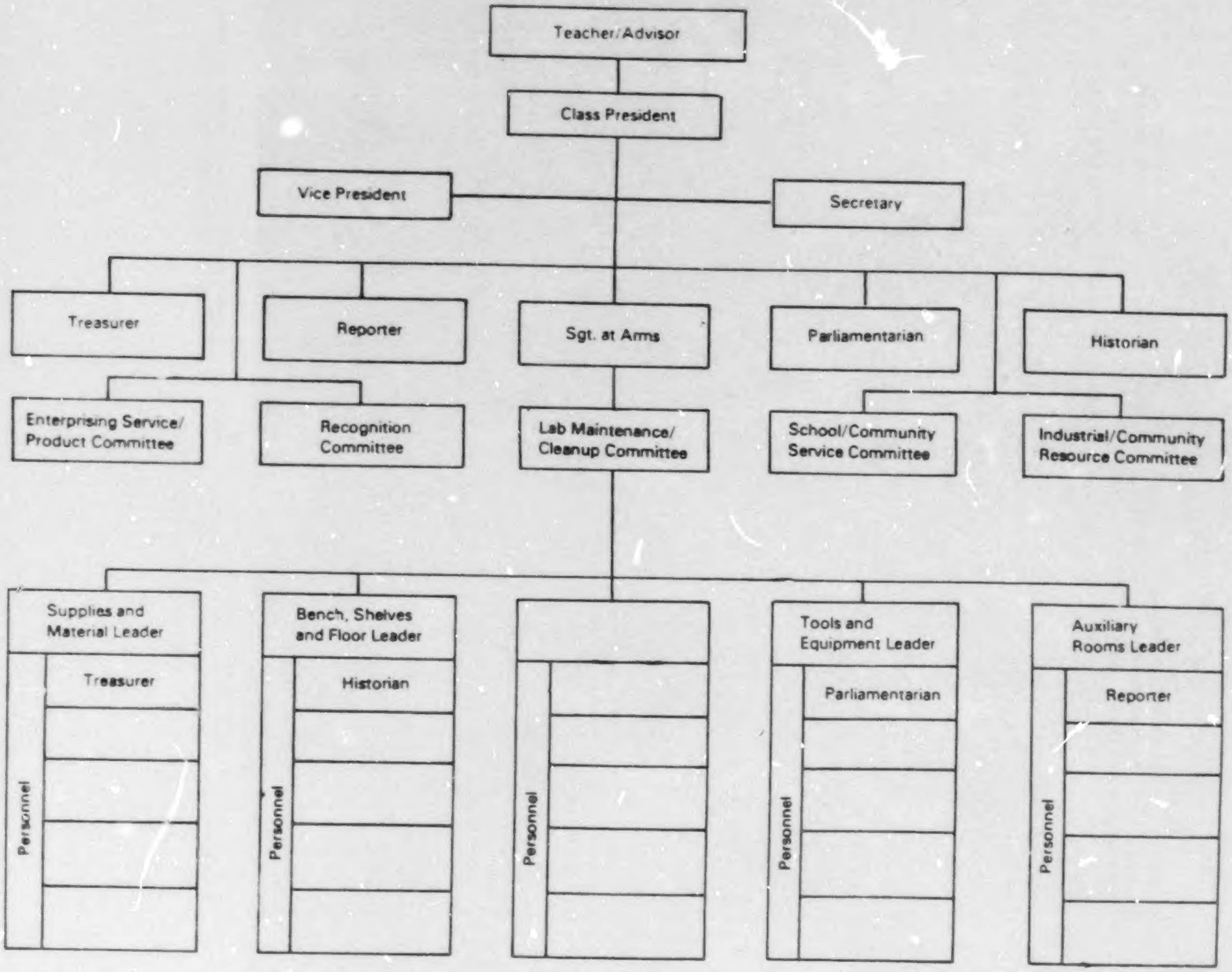
ENTERPRISING SERVICE OR PRODUCT COMMITTEE

1. Make list of products or services of economic value related to course.
2. Make prototypes of those related to unit of study.
3. Report possible products or services to class meetings for vote.
4. Organize company for production or service enterprise.
5. Keep financial records and report to class.
6. Present income for AIASA purpose to Treasurer.

RECOGNITION OF ACHIEVEMENT COMMITTEE

1. Make list of regular AIASA contests and others related to course.
2. With teacher, select or develop contests related to unit of study.
3. Report at class meetings on contests to be used.
4. Organize contest procedures and awards to be given.
5. Recognize winners with awards and newspaper articles.

ORGANIZATIONAL STRUCTURE


Teacher/Advisor
Class President
Vice President
Secretary
Treasurer
Reporter
Sgt. at Arms
Parliamentarian
Historian
Enterprising Service/ Product Committee
Recognition Committee
Lab Maintenance/ Cleanup Committee
School/Community Service Committee
Industrial/Community Resource Committee
Supplies and Material Leader
Treasurer
Personnel
Bench, Shelves and Floor Leader
Historian
Personnel
Personnel
Tools and Equipment Leader
Parliamentarian
Personnel
Auxiliary Rooms Leader
Reporter
Personnel

In-Class Meeting Procedures

Many of the routine activities of an industrial arts class can be handled by the officers of the class's student association. The **Class Meeting Agenda** should be in front of the students as poster to help each student understand meeting procedures.

1. Call to Order

President:	Raps gavel twice before saying - **Will the (class or meeting) please come to order? Sergeant At Arms, are there enough members present and in their seats to have a meeting?**
Sgt. at Arms:	**There are, (Mr. or Miss) President.** Tells students who arrive late to see Secretary for roll check.

2. Hear the Minutes of the Previous Meeting

President:	**We are ready to transact our business. Will the Secretary please read the Minutes?**
Secretary:	The Secretary stands and reads the Minutes which include date, time and place motions and other details of the last meeting.
President:	After the reading of the Minutes asks: **Are there any corrections or additions to the Minutes? (If none, the Minutes stand approved as read, or the Minutes stand approved as corrected.)**

3. Hear Reports of Officers or Standing Committees

President:	**The Assembly will hear reports of Officers.** (After each report, may ask; **You have heard the report. What is your pleasure?** For approval or adoption by motion?
Treasurer:	**The following amounts have been paid as (fees or dues) to the Treasurer $ ______________.** The amount of $__________has been paid out. The total balance is $_______ ___. The Treasurer may announce any fees to be paid or information about supplies.
Historian:	(May call for homework or assignments as part of group effort.)
Sgt. at Arms:	(May report on clean-up changes and condition of classroom and laboratories.)
Parliamentarian:	(May report or advise on procedures used for meeting or laboratory safety.)
Secretary:	(May report attendance information and give list of absent students to teacher.)
President:	**Do any Committees have reports?**
Maintenance Comm:	May report or advise.
Service Committee:	May report or advise.
Enterprising Comm:	May report or advise.
Resources Comm:	May report or advise.
Recognition Comm:	May report or advise.
President:	After each report say, **You have heard the report. What is your pleasure?**

4. Hear Reports of Special Committees

President:	**We will hear the report of the special committee for ________________________________.**
Special Comm:	May report or advise.
President:	**You have heard the report. What is your pleasure?**

5. Hear Announcements

President:	**Are there any announcements to be made at this time?**
Reporter:	May report on class progress or outside events of interest to class or school AIASA.
Open to the Floor:	Other students may announce any meetings, activities or events scheduled in the future.
Teacher:	May wish to make announcements also.

6. Unfinished Business

President:	**The floor is open for discussion of unfinished business of the last meeting.**
Secretary or Parliamentarian:	May call attention to tabled motions or details from minutes of previous meetings.
Historian:	May remind members of homework or reports assigned or collect papers for teacher.

7. New Business

President:	**The floor is open for discussion of new business.**
Open to the Floor:	Suggestions for action not discussed before at the meeting would be introduced.
President:	(When the President feels that the discussion is complete, ask:) **Does anyone desire to make a motion?** (President acts on motion, appoints a committee or calls for another new business, or may call on the teacher (Mr., Miss, Mrs. ___________, do we have a lesson?)
Teacher:	Presents lesson or announces laboratory work.

8. Adjournment of the Meeting

President:	Raps gavel twice. **If there is not further business, the meeting stands ready to adjourn.** Raps gavel 3 times. **What is our motto?**
All:	**"Learning to Live in a Technical World."**
President:	**Does anyone wish to introduce a motion to adjourn?** (Conduct vote on motion and declare adjournment) or say; Does anyone know of any reason why this assembly should not adjourn? **I declare this meeting adjourned.**

HOW MOTIONS ARE MADE

HOW TO PRESENT A MOTION

There are eight simple steps in presenting a main motion:

1. The member rises and addresses the President.
2. The member is recognized by the President.
3. The member states his idea as a motion.
4. Another member seconds the motion.
5. The motion is restated by the President.
6. The Presidents conducts the discussion.
7. The President puts the question to a vote.
8. The President announces the result.

The main motion forms the starting point for any action to be taken by the group. Informal discussion may be allowed in small groups, but to be considered, the motion must be made, seconded, and stated by the President.

The President should know the exact moment at which to stop any informal discussion. He may bring things to a head by saying:
"If definite action is sought in this matter, a motion is in order."

This is how a motion is made:

1. Stand and address the President: **"Mr. or Ms. President."** Wait until you are recognized by the President. Do not speak until you are recognized by a nod or by name.

2. Be sure you have your motion clearly in mind, and worded as briefly as possible. Write it out if you can.

3. When you have been recognized, state the motion so that all can hear: **"I move that this chapter give a rising vote of thanks to its sponsor, Mr. Gardner."**

4. After the motion has been made, another member, without waiting to be recognized, calls out: **"I second the motion."**

5. The motion having been made and seconded, the President states the motion by saying: **"It has been moved and seconded that this chapter give a rising vote of thanks to its sponsor, Mr. Gardner."**

6. When the chairman has stated the motion, it is said to be pending. It may now be considered by the group — that is, it is open to discussion and debate.

7. Any member may now rise to agree or disagree with the proposal. For example, a member may rise and say: **"Mr. or Ms. President."** The President says: "Ron," so giving him permission to speak. **"I agree with the motion. Mr. Gardner has given his time to us and we should express our gratitude to him."**

8. The President inquires: **"Is there any further discussion?"** Since no one rises to discuss the motion further, the President asks, **"Are you ready for the question?"** (The "question" is the vote.) The members call out, **"Question?"**

9. The President then puts the question — that is, he takes the vote. He or she says: **"It has been moved and seconded that this chapter give a rising vote of thanks to its sponsor, Mr. Gardner. All those in favor of the motion say 'Aye.'"**
   The members in favor of the motion say, **"Aye."**
   The President then says: **"Those opposed, say 'No.'"**

10. The President then announces the vote: **"The Ayes have it. The motion is carried."** Or, **"The Noes have it. The motion is defeated."**

KINDS OF MOTIONS

There are four kinds of motions:

1. Privileged motion
2. Subsidiary motion
3. Incidental motion
4. Main motion

Motions that concern the rights and privileges of members are called privileged motions. Because of their urgency and importance they come before all other motions. The most common privileged motions are:

1. To fix time and place for adjournment.
2. To adjourn.
3. To take a recess.
4. Matters of personal privilege.
5. Orders of the day.

You will notice that four of these motions concern general rights. They are rights reserved to the chapter: when to adjourn, when to recess and when to insist that the rules be followed. The other motion, the motion of privilege, is the most important. It refers to a member's individual and personal rights.

Let us take an example of how this motion actually works.

Whenever there is any disturbance to the assembly, such as noise, presence of non-members, quarrels between members, or unpleasant atmospheric conditions, like excessive heat or cold, you may rise to a question of privilege. Suppose there is so much noise that you cannot hear. You might stand, and without waiting to be recognized, say: **"Mr. or Ms. President, I rise to a point of personal privilege."**

The President would then tell you to state your point of privilege. You might say, **"There is too much noise. I can't hear."**

Motions of personal privilege require no second, and are immediately decided by the President. In this case, he/she might direct the speaker to talk more loudly or he might take some other measure, such as closing the windows to shut out the disturbance. Business would then be resumed.

Subsidiary motions amend or otherwise dispose of other motions. There are seven of them. The two you may want to use, however, are (1) to refer to a committee, and (2) to amend.

You use the refer to a committee motion whenever you feel that the chapter should study the proposition more carefully before voting on it. You rise and say, **"Mr. or Miss President."**

When recognized, you then say: **"I move that this question be referred to a committee."**

This motion must be seconded. It can be amended. It can be debated. It cannot be reconsidered once the committee has begun its study. It requires a majority vote.

The motion to amend seeks to modify or change the motion under consideration. When you wish to make it, you must rise and say, **"Mr. or Ms. President."**

When you have been recognized by the President, you might say, **"I move to amend the motion by striking out the word 'annual.'"**

When you make this motion, you must be sure to state definitely the way in which you want the amendment made.

Motions that arise out of debate are called incidental motions. They are concerned with small matters that can readily be settled. For example, a member desires to know some matter of information (point of information) or a member desires to question a vote (divide the assembly), or a member desires to know if the proper procedure is being followed (point of order).

A main motion brings a new proposal before the chapter. It is only in order when no other main motion is being debated.

A main motion is subject to six conditions:

1. It must be seconded.
2. It can be amended.
3. It can be debated.
4. It can be reconsidered — that is, brought up a second time.
5. It can have additional motions that change it.
6. It requires a majority vote.

DUTIES FOR IN-CLASS USE OF COMMUNITY RESOURCES

This activity will help students learn how to invite and properly use a guest speaker in the Industrial Arts class. The particular content of the course or lesson will determine the type of resource person who should be contacted. The student learns to call, talk with, write letter, and introduce a speaker as part of classroom instruction.

Officer and Committee Duties

Community Resources Committee	This committee of the class meets often during the semester to find ways for industry and community resources to be used for the Industrial Arts class or laboratory. Types of resources include speakers, field trips and laboratory materials which help class with chosen activity. Teacher may suggest possible speakers related to technical or career aspects of the course.
President:	Opens meeting to hear report of Community Resources Committee and involve class in deciding resources for class to use. Relatives, friends, industrial workers or business leaders may be suggested by class members. Class votes to use a resource in cooperation with teacher and school office.
Vice-president:	May prepare simple questions for class members to ask speaker.
Secretary:	Records suggested names of community resources and records any decisions made by class.
Treasurer:	Most speakers will not require any financial assistance; however, if near lunch period the class may ask person to stay for lunch at school.
Parliamentarian:	Helps class use proper procedures for inviting, talking to and thanking a resource speaker.
Reporter:	Assures speaker will be met by committee or officer. Obtains information about speaker to announce to other teachers if appropriate.
Sgt. at Arms:	Assures speaker is not interrupted while talking with class.
Historian:	Records or videotapes speaker so speech can be saved for use with other classes.

TYPICAL SCHEDULE FOR USING A SPEAKER

class Meeting 1.	Teacher explains that there are various resource persons in the community who could speak to the class and help them learn additional information.
2&3.	Students survey community for resources related to the topics of the course.
4.	Industrial/Community Resource Committee reports to class on those resource person they have considered good for the course content.
	Class officers conduct meeting of class to vote on one person to invite to speak.
5.	Committee writes letter to invite resource person giving dates suggested by teacher and with approval of principal's office.
6&7.	Committee prepares questions and gathers information related to speaker or the industry.
8.	Teacher follows up letter by calling the speaker to discuss dates, times, topic and school policies related to outside speakers.
Day of Speaker –	Committee meets speaker at arrival time and introduces speaker to principal, teacher and class. (Other teachers or classes may also attend.
	Class members ask questions at appropriate time. Other committees or groups may seek advice on their activities or projects using the resource person as a consultant.
After speech	Reporter writes news story about speaker and talk.
	Thank you letter is written to speaker.
	Recordings of speech are shared with other classes or information is filed so that speaker can be invited again.

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DUTIES FOR IN-CLASS SERVICE PROJECTS

This activity will use the procedures of the "Group Project" method which begins on Page 48 of the Exploring Technology Guide. The method uses "student involvement, interaction and skills to produce one or more tangible products . . ." Leadership and followership are developed as students work together in the laboratory as one industry to produce a product.

Officer and Committee Duties

Service Committee:	Meets to screen or encourage and select a service project for the class to build.
President:	Opens meeting to hear report of Service Committee and involve class in decision. Class votes on service to be provided to another group.
Vice-president:	Reproduces organizational chart for group project system and asks class to determine who will take each position.
Secretary:	Keeps minutes of class meeting and records names of students who are members of group project.
Treasurer:	Advises class on financial details related to service project.
Parliamentarian:	Advises class on proper procedures for obtaining permission.
Sgt. at Arms:	May suggest services or improvements needed within laboratory such as tool holders or safety devices.
Reporter:	Writes story about plans of class to build a service project to help others. Takes photos of work and delivery for story.
Historian:	May share information on previous projects related to this one. Keeps records for other classes to use for reference.

TYPICAL SERVICE PROJECT SCHEDULE

Class Meeting 1. Teacher explains group project method to class and students discuss possible service projects for Service Committee to consider.

2. Service Committee reports to class a recommended service project and class selects project to build.

3. Class Vice-President distributes organizational chart for Group Project and may have students apply for positions.

4. Students report during seminar on role or duties they hold in Group Service Project. Research and Design Directors work to determine specifications and prepare drawings.

5. Students apply for jobs in the organization.

6, 7 & 8. Teacher may demonstrate technical areas related to project selected as needed in construction.

9. Students use laboratory to build sub-parts of project.

10. Reporting seminar permits students to present work completed or problems solved.

11. Students use laboratory to assemble or complete project.

12. Reporter and Historian write stories for public information.

13. Teacher evaluates each student's participation as to technical knowledge gained and interest in helping others.

DUTIES FOR IN-CLASS ENTERPRISING PRODUCTS

This activity will use the procedures of the "Line Production" method which begins on page 49 of the **Exploring Technology Guide**. The method is used "to acquaint students with: the ways in which contemporary industry organizes people, materials, and machines into a common endeavor; the study of occupations related to areas of management and labor within industry . . ." The student learns to develop a company, solve management problems and realize profits from a salable product or service.

Officer and Committee Duties

Enterprising Committee:	This committee of the class meets separately to design or select products or services to enterprise for a profit. May use criteria for product selection, sketches or mockups. Organize sales training for all class members such as: Making sales presentations, taking orders and keeping records of sales contacts made, good manners and courteous behavior.
President:	Opens meeting to hear report of Enterprising Committee and involve class as Board of Directors in deciding what product to make and how profit will be used after product is sold.
Vice-President:	Reproduces an organizational chart of a company and sample personnel roles for distribution to students.
Secretary:	Records information decided by Board of Directors and result of voting for General Manager in the company.
Treasurer:	Helps determine financial needs of class and determine capital needed to begin production. Suggests recordkeeping system for enterprise.
Parliamentarian:	Prepares mock incorporation papers for the company and obtains approval from school officials with teacher.
Sgt. at Arms:	Assigns cleanup duties appropriate to production activity of class.
Historian:	Files records and samples of every phase of activity for other classes to use.
Reporter:	Selects or makes promotion materials to advertise product or service to school.

TYPICAL ENTERPRISING PRODUCT SCHEDULE

Class Meeting 1. Teacher explains line production method that class will use to raise funds for activity they select.
2. Enterprising Committee reports to class showing sketches or mockup models of products which could be produced and sold. Class votes on product and activity as the Board of Directors.
3. Vice-President distributes organizational chart for company. Class votes for person to lead as General Manager.
4. General Manager selects second line management and the Personnel Director to hire all other employees.
5. Design Engineer presents drawings to class and will prepare a very accurate prototype with the help of the production and industrial engineering departments.
6. Assess school for product sales appeal
7. Each person will report on completed duties accomplished in the role held.
8. Personnel Manager will assign students to make necessary jigs and fixtures.
9. Assign students to work stations and try out a test run.
10. Production of products on assembly line.
11. Advertising personnel will design and produce posters and order forms for product sales.
12. Prepare a marketing management system to control products. Record who is contacted and sales information.
13. Deliver product to customer.
14. Account for all purchases, sales and losses.

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DUTIES FOR IN CLASS CONTESTS OR RECOGNITION

This activity will involve students in contests which are provided at local, regional, state and national conferences. Thus, students may practice and compete in tool identification, prepare an exhibit or give a speech as part of the way they are learning Industrial Arts. The teacher should suggest those contests to the Recognition Committee that relate to the course the students are taking.

Officer and Committee Duties

Recognition Committee:	This committee of the class meets to determine what contests relate to class and study rules for possible contests to be held in class or laboratory.
President:	Opens class meeting to hear report of Recognition Committee and involve students in selecting contest for class to use.
Vice-President:	Assists with organizational chart to show how students will compete.
Secretary:	Writes letters to persons who will be asked to serve as judges.
Treasurer:	Assists in determining and purchasing awards to be given to winners.
Parliamentarian:	May help select judges for contests and review rules for participation.
Sgt. at Arms:	May assist judges in keeping order or use of rules.
Reporter:	Writes up news stories about contests, exhibit or demonstration and announces winners. May invite community or other students to see contests.
Historian:	Keeps records of each activity and files records or photos for future reference.

DUTIES FOR IN CLASS OPEN HOUSE EXHIBITS

This activity will involve students in gaining recognition for their achievements in this industrial arts course. The officers of the class will assist with the activity and every student will not only help but will also contribute projects to be exhibited.

OFFICER AND COMMITTEE Duties

Recognition Committee:	This committee of the class meets to determine what type of Open House will be appropriate to the course and works with teacher to arrive at the best date.
President:	Opens class meeting to hear report of the Recognition Committee and involve class members in the decisions related to the Open House.
Vice-President:	Assists with the organizational procedures and work assignments of committee members and officers.
Secretary:	Writes letters or helps with invitations send to school personnel and others class wants to invite.
Treasurer:	Records expenses incurred during the Open House activity and seeks funds to meet these costs.
Parliamentarian:	Makes sure that proper procedures are followed as visitors are invited or other arrangements are made within the class or school.
Sgt. at Arms:	May assist committee in setting up exhibit tables and arranging for or cleaning up after open house.
Reporter:	Helps to publicize the Open House around the school. Takes photos and writes sto[illegible] before and after the event for the newspaper.
Historian:	Files and keeps information or photos of the event for use by future students.

SCHEDULES FOR RECOGNITION EVENTS

USING A CONTEST IN CLASS

1. Teacher presents idea and purpose of contest during class time.
2. Recognition Committee suggests possible contests for class to use.
3. Officers lead class meeting to decide of contest to be used.
4. Committee reviews or plans rules and organizes time schedule for individuals to compete.
5. Students practice during class or as homework.
6. Students or other judges select up to six finalists.
7. Finalists compete before judges and awards are presented to each.
8. Reporter and other officers carry out their duties.

ENTERING A CONTEST

1. Obtain and study contest guidelines or rule books.
2. Complete forms to pre-register in contest.
3. Mail forms to Spring Festival Contest Chairperson.
4. Prepare and practice for event in class, school and as homework.
5. Demonstrate to class and other school groups for judging or criticism.
6. Dress and conduct oneself appropriately for judging.
7. Appear at scheduled time for contest and awards program.

HOLDING AN OPEN HOUSE

1. Class decides if open house will be by class alone or request school AIASA to cooperate.
2. Obtain permission from school office date and place of open house.
3. Organize class members to help with various set-up details.
4. Announce to students how to enter projects for open house exhibit.
5. Send invitations to school personnel, parents and community resources.
6. Provide recognition for those who participate.

GIVING A TECHNICAL DEMONSTRATION

1. Select a technical topic which would interest or help other people.
2. Prepare research report or speech on the topic of demonstration.
3. Make models or assemble tools for demonstration.
4. Practice giving demonstration in class, school or as homework.
5. Arrange time and place to give demonstration such as State Fair, shopping mall or open house.
6. Dress and conduct oneself in professional way prior to and during demonstration.
7. Provide demonstration and answer questions of those who watched.

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REGIONAL, STATE AND NATIONAL RECOGNITION EVENTS FOR INDUSTRIAL ARTS STUDENTS

TECHNICAL PERFORMANCE CONTESTS
- Architectural Drawing
- Engineering Drawing
- Electricity/Electronics
- Graphic Arts
- L.S.R.A.V. (model race cars)
- Leathercraft
- Photography
- Metal Machining
- Small Engine Trouble Shooting
- Tool and Machine Identification
- Woodturning - between centers
- Woodturning - face plate
- Screen Process Printing (hand cut film)
- Metric 500 Race

GENERAL CONTESTS
- General Knowledge Test
- Public Speaking Contests (prepared and extemporaneous)
- Chapter Team Contest
- Research Paper Entry Contest
- Safety Poster Entry Contest
- Technical Writing Contest

Booth or Display Contests
- Co-Curricular Activity Exhibit
- Community Service Project Exhibit
- Scrapbook or Record Book Exhibit
- Fund Raising Project Exhibit
- Booth Exhibit

PROJECT EXHIBIT CONTESTS (enter by course title and course code)
- Exploring Technology
- Modern Industry
- Construction
- Manufacturing
- Communications Technology
- Materials and Processes Technology
- Power and Transportation Technology
- Architectural Drawing
- Basic Technical Drawing
- Electricity and Electronics
- Energy and Power
- Engineering Drawing
- Graphic Communications
- Metals Technology
- Woods Technology
- General Industrial Arts
- Industrial Crafts

(for other titles see Spring Festival Permanent Rules)

CHECKLIST FOR CONTEST PARTICIPANTS

Directions: Performance and leadership contests are judged on the following aspects. To assist students to improve themselves for the contest these statements can be checked off by another person.

Technical Understanding

__________ 1. Accurate information used from books and research.
__________ 2. Impact or value of technology understood.
__________ 3. Safety procedures are used or described.
__________ 4. Information reviewed or approved by teacher.

Leadership

__________ 1. Leadership ability is exhibited.
__________ 2. Experienced as officer or participant in AIASA.
__________ 3. Voice and mannerisms are appropriate.
__________ 4. Assists with projects of class.
__________ 5. Helped arrange materials and forms for entry into contest.
__________ 6. Sent registration materials to contest chairperson.

Career Information

__________ 1. Knows at least 5 careers related to contest.
__________ 2. Understands requisites for career entry.
__________ 3. Lists programs for occupational preparation.

Performance

__________ 1. Shows interest and enthusiasm.
__________ 2. Dressed appropriate to contest.
__________ 3. Presents or demonstrates information in orderly manner.
__________ 4. Develops eye contact.
__________ 5. Voice and manner professional.
__________ 6. Paper organized well and holds interest.
__________ 7. Writing is accurate and to the point.

4

Energy Conservation

OBJECTIVES

After the students have covered the material in this unit, they should be able to—

1. describe the different types of alternative energy sources and how they are used in the construction industry;
2. apply the basic principles of energy conservation from both a technical and a consumer standpoint;
3. apply energy conservation techniques in meeting the future needs of society; and
4. run a simple energy audit.

KEY WORDS: VOCABULARY

The words in the following list may be new to the students studying construction. Teachers should help students understand these words as they are used in this topic of study.

energy
energy conservation
alternative energy
solar energy
wind power
geothermal energy
underground dwelling
passive solar systems
active solar systems
biomass energy
nuclear energy
energy audit

TEACHING AIDS

- Overhead projector
- Appendices A and B
- Test Key: 1-B, 2-C, 3-A, 4-D, 5-A, 6-C, 7-B, 8-D, 9-A, 10-C
- Transparencies: You will find transparencies C4-1 through C4-7 at the end of this unit. If you wish, these masters may be duplicated in quantity and given as handouts to the students while they are studying the different aspects of this unit.

  C4-1: What Is Energy?
  C4-2: Energy Conservation Techniques
  C4-3: Solar Energy as an Alternative
  C4-4: Wind Power
  C4-5: Geothermal Energy
  C4-6: Nuclear Energy
  C4-7: Biomass Energy Sources

SUGGESTED REFERENCES

Ametek, Inc. Solar Energy Handbook Theory and Application. Radnor, Penn: Chilton Book Company, 1979.

Garrison, A. Joseph. Solar Projects. Philadelphia: Running Press, 1981.

Hughes, Larry R. Energy Systems. Austin, Tex.: Extension Instruction and Materials Center, The University of Texas, 1983.

Lucus, Ted. How to Build a Solar Heater. New York: Crown Publishers, 1980.

Temple, Peter L., and Adams, Jennifer A. Solar Heating: A Construction Manual. Radnor, Penn.: Chilton Book Company, 1981.

Towler, Alan L. Power Systems. Austin, Tex.: Extension Instruction and Materials Center, The University of Texas, 1983.

SENTENCE OUTLINE (Transparency C4-1 and C4-2)

I. Different types of alternative sources
  A. Solar (Transparency C4-3)
    1. The sun's rays are a direct source of energy.
    2. Scientists have been trying for years to use the sun's energy.
    3. Scientists estimate that only 13 percent of the sun's energy reaches the earth. But even this small amount is useful.
    4. It seems logical that we should try to use as much of this energy as possible.
    5. Solar energy seems to be nonpolluting.
    6. Though it is present during the day, solar energy is not available during the night. Less is available on cloudy days, since clouds block much of the sun's radiant energy.
    7. It is necessary to store the energy collected when the sun is shining so that it can be used at night and during times when the sun is clouded over.
    8. Advantages
      a. It is nonpolluting.
      b. It does not increase the earth's thermal burden.
      c. Solar plants are relatively easy to construct.
    9. Disadvantages
      a. Earth-based solar converters work only when the sun is shining. They are intermittent and function at a low intensity.
      b. Wind increases the heat burden of the biosphere.
    10. Types of solar systems
      a. **Passive.** This direct-gain system allows the sunshine to pass through windows and heat whatever it strikes.
      b. **Active.** This indirect-gain system collects and delivers the stored heat to any part of the house or building when it is needed.
    11. Solar panels are placed on the southern exposure of the house to obtain the most efficient direct gain from the sun.
  B. Wind power (Transparency C4-4)
    1. The wind, like flowing water, is a source of energy.
    2. Also, like water, the wind has been used as an energy source for hundreds of years.
    3. The metal-vented windmill was common on farms in the U. S. many years ago. It is being used more and more as an alternative energy source.
    4. But windmills are limited. They only work when the wind is blowing.
    5. If windmills are to be used as a major source of energy, then some method of storing the energy produced is needed.
    6. At best, wind power will probably be used as a supplementary source.
    7. Advantages
      a. Wind is everywhere, free and plentiful.
      b. It is nonpolluting.
      c. It has no thermal disadvantages.
    8. Disadvantages
      a. It gives relatively unstable output.
      b. Wind must move at speeds greater than seven miles per hour to effectively be used to produce energy.
  C. Geothermal (Transparency C4-5)
    1. The heat inside the earth is a possible source of energy.
    2. Some countries have been using this heat energy, called geothermal energy, for years.

3. Geothermal energy is limited to those areas of the earth where steam and hot water are near the surface.
4. When this occurs, wells can be drilled. The steam or hot water can be piped into turbines, and electricity can be generated.
5. Scientists believe that very hot rock lies two to five miles below the earth's surface in many places. In these places, scientists believe that water can be forced down wells into the hot rock.
6. The rock heats the water into steam. This steam can be piped back to the surface where it is used to turn turbines.
7. The steam can be cooled and condensed into water, which is repumped into the wells to be reheated and reused.
8. Many problems arise when using geothermal heat as a source of energy.
9. Though it is working in some places (Northern California), it is not practical everywhere. And it may not be practical on a large scale.
10. Advantages
    - a. A plentiful supply exists.
    - b. The cost is lower than for plants of comparable size that use fossil or nuclear fuels.
    - c. It takes less time for plant setup and operation.
11. Disadvantages
    - a. It is less efficient. Only 30 percent of the output may be used to run the pumps.
    - b. Environmental dangers:
        1. disposal of hot water and high mineral content
        2. disposal of hot water produced by condensation in the conversion process
        3. release of noxious gases into the atmosphere such as sulfur, ammonia, and boron.

D. Nuclear

1. Many scientists and technologists believe nuclear energy can and will replace fossil fuels as our main source of energy.
2. But there are many problems with nuclear energy.
3. It must be controlled very carefully to prevent the escape of radiation or invisible rays of powerful energy.
4. The waste from nuclear generating plants must be stored for hundreds of years before it is safe for human contact.
5. These generating plants require large quantities of water for cooling.
6. This water, when released from the plant, is hot and can have serious effects on fish and plants in the rivers and oceans.
7. In the process of nuclear fission, the nucleus or center of the atom of the fuel (plutonium or uranium) is split.
8. This gives off radiant energy, which produces heat.
9. Neutrons or parts of the atom are also released.
10. These collide with the centers of more atoms, causing them to split.
11. As the reaction continues, intense heat is give off.
12. The heat is used to change water into steam.
13. The steam is used to drive turbines.
14. The turbines turn generators which generate electricity.
15. If this chain reaction is not controlled, it can become a nuclear explosion.
16. The atomic bombs exploded over Japan at the end of World War II are examples of this kind of chain reaction.
17. Of course, this possibility is a worry to all nuclear scientists and people living near nuclear power generating plants.
18. But scientists have learned to control nuclear fission. The chance of a nuclear explosion is small.

19. After the fuel is used in a nuclear reactor, the waste must be disposed of or discarded.
20. A certain amount of it can be reprocessed into more fuel that can be used in the power plants.
21. The small amount of remaining waste still is radioactive and very dangerous.
22. There seems to be no way to get rid of these materials.
23. Burial of waste in old salt mines has been tried but has not been successful.
24. Research into solving the problems of nuclear waste disposal continues.
25. Advantages
    a. A large fuel supply exists.
    b. Less long-lived dangerous wastes result than with fission.
    c. The risk of accidents is very low.
    d. Fuel processing is done at the reactor site.
    e. It requires no combustion of the earth's oxygen.
    f. No air is emitted.
26. Disadvantages
    a. It is not technically feasible at the present time.
    b. There may be significant amounts of tritium leakage.
    c. There may be large amounts of thermal pollution.

II. Basic principles of energy conservation
  A. Energy consumption can be reduced by eliminating energy waste and by changing one's lifestyle.
  B. Energy conservation techniques
    1. Reducing air infiltration
      a. Caulk all cracks around windows, doors, and joints.
      b. Weatherstrip windows and doors.
      c. Close all openings and vents whenever possible.
      d. Reduce force air ventilation, if possible.
      e. Install a wind screen by landscaping the site or planning the building groups.
    2. Reducing heat transmission
      a. Install adequate insulation in roof, walls, and floors.
      b. Add movable insulation and/or storm doors and windows whenever possible.
      c. Reduce heat transmission between the space and the exterior of the building.
      d. Provide shading devices to reduce solar exposure in the summer.
      e. Lower the winter heating temperature.
      f. Raise the summer cooling temperature.
    3. Increasing equipment use efficiency
      a. Use proper equipment maintenance.
      b. Replace the equipment with a more efficient model.
      c. Reset operating temperatures based on demand.
      d. Reduce or shutoff systems in unused spaces.
      e. Avoid partial-load operating of equipment.
      f. Match the size of the equipment with the demand.

4. Reducing energy leaks and eliminating unnecessary energy use
    a. Provide proper and better maintenance.
    b. Repair and insulate the distribution system.
    c. Reset appropriate temperature settings in winter and summer as well as day and night.
    d. Reduce or shut off systems when space is not being used.
5. Natural energy systems
    a. retrofit solar energy system may possible be used in existing buildings. They may provide as much as 80 percent of the energy demand, with at least a 20 percent savings.
    b. passive solar systems
        1. direct gain
        2. indirect gain
    c. active solar systems, such as domestic hot water heaters
    d. wind power
    e. biomass sources (Transparency C4-7)

III. Energy conservation for little or no cost
- A. "Close" all openings to the exterior and to unheated spaces when the space is not in use.
- B. Close the exhaust or ventilation dampers in fireplaces. Completely cover the fireplace openings, if possible, when not in use.
- C. Close or cover all exhaust or ventilating openings of mechanical equipment; in winter, window or through-wall air conditioning units; summer, ventilators, and so on.
- D. Clean all filters in air ducts and surfaces of all radiators. Drain sediment and mineral deposits from hot water heater. And adjust all gas burners to produce a clean blue white flame.
- E. Reduce hot water heaters to "low" temperature setting (120°F if possible, 140°F, if dishwasher is used). Reduce daytime heating. And increase daytime thermostat setting to 72°F or higher, and to 78°F at night for summer cooling.
- F. For winter, close all draperies at night and open for sunshine. For summer, close draperies in daytime and open at night.
- G. Turn off all power equipment when not in use, and all lights in unused spaces.
- H. Have a professional turnoff your gas stove pilot, instead of using matches to light the burners. When purchasing a new stove, buy one with electronic ignition.
- I. Take short showers, use less hot water, use water-flow limiters in hot water faucets, or establish lower flow rates in your faucets.
- J. Use home appliances only in "FULL" load condition, and match the size of the appliance with the task.

IV. Energy conservation techniques for little or some cost
- A. Caulk all cracks around windows, doors, openings, and wall joints, and so on.
- B. Weatherstrip overlaps and joints of windows and doors.
- C. Repair small cracks and openings on outside of building surfaces, such as broken glass, or loose frames.
- D. Insulate pipes and ducts in unheated basement, attic, and crawl spaces.
- E. Insulate doors and cover unheated spaces.
- F. Insulate "older" hot water heaters.
- G. Install attic ventilator for summer cooling, if ceiling is not well insulated.
- H. Install glass screen in fireplace opening, and introduce direct outside air to combustion chamber.
- I. Repair all indoor systems to reduce leakage in air ducts, steam pipes, water faucets, and exhaust dampers.
- J. Replace the existing single-action thermostat with automatic temperature reduction and night setback control for winter heating.

V. Energy conservation for some cost or large investment which requires economic justification
  A. Add 3 1/2-inch insulation on top of existing ceiling insulation of 6 inches or less, or add no more than 6-inches insulation when existing insulation is less than 3 inches more.
  B. Insulate floor over vented crawl space with no less than 6-inches, and over unheated basement with 3-inches or more.
  C. Insulate exterior walls.
  D. Install storm windows and doors.
  E. Install solar hot water system as preheater to existing water heater.
  F. Replace all incandescent lamps with fluorescent lighting, if possible.
  G. Replace all "out-dated" equipment with higher-efficiency equipment, such as converted coal furnaces, refrigerators, freezers, hot water heaters, and window air-conditioners.
  H. Install a new control system to provide individual "ZONE" control for possible reduction of load operation or for complete shutoff when spaces are not in use.
  I. Retrofit active solar systems.

VI. Energy auditing
  A. Knowing basic energy auditing techniques can save the consumer many dollars over the year.
  B. Through an energy audit, consumers will find out that they can do a great deal themselves to conserve energy at little or no cost.
  C. The two basic energy auditing methods or techniques are:
    1. professional energy audit
    2. personal energy audit (the walk-through audit)
  D. The walk-through auditing process
    1. Building enclosure check from exterior
      a. Check wall/siding joints for cracks, gaps, and/or missing caulking.
      b. Check window/door for broken/missing glass.
      c. Check window/door for disrepair joints, cracks, and missing caulking.
      d. Check window/door for poor or missing weather stripping.
      e. Check window/door for unusual openings.
      f. Inspect all exhaust openings for missing or inoperable back-draft cover or mechanism.
      g. Note condition of storm windows/doors.
      h. Note building shading condition.
      i. Note unusual colors or finishing condition of building surfaces.
    2. Building enclosure check from interior
      a. Test infiltration for all joints.
      b. Check all doors closure mechanisms.
      c. Note unusual heat transfer problems.
      d. Note unusual colors or finishing conditions of walls, ceiling, and floor surfaces.
      e. Note any displacement of wall, ceiling, and floor joints.
      f. Note building shading conditions.
    3. Interior survey—space use
      a. Determine any waste space.
      b. Determine any poor circulation problems.
      c. Note any space use and egress problems.
      d. Note any space use management problems.
      e. Inspect the effectiveness of natural ventilation.
      f. Inspect the effectiveness of winter windbreaks.
      g. Inspect the effectiveness of shading controls.
      h. Note any subsystem integration problems.

4. Interior survey—lighting and power distribution
   a. Determine any inefficient lighting sources.
   b. Determine any useless lighting or lighting using too many footcandles.
   c. Inspect the effectiveness of lighting controls.
   d. Inspect the effectiveness of daylighting.
   e. Inspect the effectiveness of task lighting.
   f. Note any maintenance problems.
   g. Note cracks from power line connections.
   h. Note cracks from wall outlets.
5. Interior survey—fireplace
   a. Determine the source of combustion air.
   b. Inspect damper conditions.
   c. Inspect glass door conditions.
   d. Note any waste heat recovery systems or devices.
   e. Note any control adjustment for space heating.
6. Mechanical systems survey—plumbing
   a. Check water flow rate of sink faucets.
   b. Check water flow rate of shower heads.
   c. Check water use capacity of water closets.
   d. Check water temperature of hot water outlets.
   e. Check all piping insulation.
   f. Note any unusual pipe system distribution or locations.
   g. Inspect any water leakage.
   h. Check water temperature settings of hot water heater/boiler.
   i. Check insulation conditions of hot water storage tanks.
   j. Check insulation conditions of hot water heater/boiler.
   k. Check pilot ignition systems.
   l. Note any waste heat recovery device.
   m. Note any obsolescent equipment.
   n. Check exhaust gas conditions.
   o. Note any maintenance problems.
7. Mechanical systems survey—HVAC system
   a. Check space temperature, and compare with thermostat readings.
   b. Check space seasonal temperature settings and note any reset schedules.
   c. Check insulation condition of equipment.
   d. Check insulation condition of the delivery system.
   e. Check any leakage from the system.
   f. Note any maintenance problems.
   g. Check any waste heat recovery device.
   h. Check any obsolescent equipment.
   i. Inspect all dampers of exhaust and air intakes.
   j. Inspect caulking around joints of exhaust and air intakes.
8. Survey of unheated spaces
   a. Check all space air vents.
   b. Check insulation condition of adjoining walls, floors, and/or partitions.
   c. Check manhole, door, and exitway conditions of adjoining walls, floors, and/or partitions.
   d. Check cracks and openings to adjoining walls, floors, and/or partitions.
   e. Check insulation conditions of piping and duct systems in the unheated spaces.
   f. Check cracks and openings from power line connections, lighting fixtures, and junction boxes.
9. Exterior survey
   a. Check building orientation problems.

b. Check exterior shading devices.
c. Check landscape feature for summer shading and winter windbreak.
d. Check solar access. (Plot the skyline or solar window projection)
e. Inspect the building geometry.
f. Note exterior surface finishings.
g. Note building ground reflectance.

MATERIALS FOR STUDENTS

- Vocabulary worksheet
- Student activities
- Energy audit materials
- Handout

SUGGESTED STUDENT ACTIVITIES

1. Have students select an energy conservation topic to research and construct a model to depict their research. Examples of topics:
   - solar energy
   - coal gasification
   - home insulation techniques
   - wind power
   - biomass energy
   - water reducers
   - hydrogen fuels
   - nuclear energy
   - geothermal energy
   - underground dwellings
   - heat pumps
2. Have students log and chart the water and electric consumption of their home over the school year to determine energy consumption and energy savings.
3. Have students run an energy audit on the school building. Give their suggested recommendations to the principal. This can be used as an AIASA service project. (See energy audit handouts that follow).
4. Have students run an energy audit on their home. Their listed findings and suggestions will be discussed in class.
5. Have students organize an energy conservation fair and exhibition, working with the local AIASA chapter and local business and industry. The fair and exhibition can be held at a local shopping mall. Student energy projects may be exhibited, students may compete in an energy conservation contest, commercial and industrial exhibits may be set up, and energy agencies may provide free and technical consumer information.

PROCESS SUMMARY OF PRELIMINARY RETROFIT EVALUATION

PART I BASELINE SURVEY

1. Building Measurements:

A. Obtain building blue-prints, check as built, and check all needed measurements (see GUIDELINE I-1.2)

B. If no blue-prints available, or incomplete plans, measure critical dimension of the building as needed (see GUIDELINE I-1.2)

2. The Enclosure Elements: Determine materials composition and parts of the building enclosure elements such as roof-ceiling, walls, floors, windows, doors, etc. FORM BS-2.

3. The Utility Records: Obtain, from the owner or utility company, the utility records such as power, natural gas, fuel oil, coal, water, etc., for the past five years, if possible, FORM BS-5, 6, & 6A.

4. Skyline Survey: Survey the skyline by locating the altitude angles of each selected bearing angle on a sun chart fo the location.

5. Energy Audit Checklists: Walkthrough the building by inspect the building elements and parts to complete the checklist, CL-15 (see TN-39A).

6. The Environmental Data: Obtain environmental data for the location such as climate and solar data may be obtained from national climate center NOAA, Ashville, Tenn., and, if possible, record local data when available.

7. Personal Interview: By review the checklist with the owner or manager of the building to determine the conditions and data may not shown on building elements or parts, especially the energy management aspect of the building use, see TN-39A.

PART II BASIC COMPUTATION AND ANALYSIS

1. U-factors

A. Determine R-values of building elements and parts, FORM BS-2 (see TN-2).

B. Compute the U-factors, FORM BS-2 (see TN-2).

C. Compute the Uo for Energy Conservation Code requirements, FORM BS-3 (see TN-2).

2. BLC or AU-factors

A. Compute Building Loss Coefficient (BLC) due to heat transfer loss (BLCHT) and air infiltration loss (BLCAI), FORM BS-4.

BLCHT = 24 Fx X A X U Btu/^{o}F-Day
BLCAI = 24 (0.018) Q Btu/^{o}F-Day
= 0.432 Vq X AC Btu/^{o}F-Day
BLC = BLCHT + BLCAI Btu/^{o}F-Day

B. Estimate the Annual Heating Demands (HD)

HD = BLC X DD/10^{6} MMBtu/yr

C. Estimate the Annual Heating Energy Demands (EDH)

$EDH = \frac{HD}{(Hv/10^6)\ Ef}$ Units of energy

3. EUI and EB

A. Compute the Energy Utilization Index (EUI)

$EUI = \frac{BLC}{Agf}$ $Btu/ft^2\text{-}^{o}F\text{-}Day$

B. Compute the Energy Budget (EB, Energy Performance Standards for New Buildings)

$EB = EUI \times DD/10^3$ $MBtu/ft^2\text{-}Yr.$

C. Compute the Energy Demand Budget (EBG)

$EBG = EB/Ef$ $MBtu/ft^2\text{-}Yr.$

PART III ENERGY USE ANALYSIS

1. Energy Use Pattern

A. Energy Use Curve: From available record, compute the average monthly energy used, FORM BS-5, and plot the energy use curve.

B. Multi-fuel Conversion: When there are more than one fuel used in the building, it is necessary to conver the fuel into net Btus before total Btus can be computed. To conver back the fuel used, the combined equipment used efficiency (Efo) must be computed, FORM BS-6 & 6A.

$BTUG = BTU/Efo$ Btu/month or year

$$Efo = \frac{\Sigma(\text{Units of Energy Used} \times Ef)}{\Sigma(\text{Units of Energy Used})}$$

2. Energy Budget Computation

A. Gross Energy Budget: Computation based on the total energy used.

$EBG = BTUG/Afg \times 10^3$ $MBtu/ft^2\text{-}yr.$

B. Net Energy Budget: Computed only on the seasonal energy use.

$EB = BTU/Afg \times 10^3$ $MBtu/ft^2\text{-}yr.$

ENERGY AUDIT

FUEL CONVERSION

PAGE

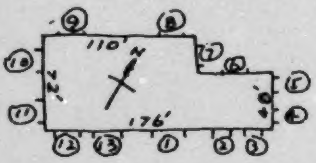
ANNUAL HEATING FUEL DEMAND (ESTIMATED):

$$EDH = \frac{HD}{Hv \times Ef}$$

FUEL TYPE	UNIT	Hv	Ef	
Power	KWH	3413	1.00	(0.77 to 1.20)
Natural Gas	CCF	0.1×10^6	0.60	(0.50 to 0.78)
#2 Fuel Oil	GAL	0.14×10^6	0.50	(0.44 to 0.78)
Coal	TON	18.0×10^6	0.23	(0.23 to 0.28)

	ENERGY AUDIT	PAGE
	BUILDING MEASUREMENT	1

STEP 1 On the graph (FORM BS-1A), one per floor, sketch the floor plan(s), approximately scaled (as indicated by the square such as 5 ft X 5 ft per square). If not, write down the dimension (measured length) on the sketch where the sizes are located, see example below.



STEP 2 In the middle of the floor plan, draw a cross with an arrowhead pointed to the north direction to indicate the orientation of the building, see example in STEP 1.

STEP 3 Along the exterior wall of the building as shown in the floor plan, indicated by two short lines the approximate location of doors, windows, and openings, and identify each by a number as illustrated in STEP 1.

STEP 4 In the lower half of the FORM BS-1A for each door, window or openning, first identify with the number as shown on the sketch, record the height and width, and check any items appliable.

STEP 5 On the graph (FORM BS-1B), sketch the elevations (or sections as needed) of the building, approximately scaled (as indicated by the square). If not, write down the dimension (measured height) on the sketch where the sizes are located. Sketch also the doors, windows, and opennings on the elevations but without the dimension (the dimension is already recorded in the table on FORM BS-1A).

STEP 6 If possible, describe the composition of the roof-ceiling assembly or the R-value (or U-factor), or sketch the section and identify the materials used on the bottom of FORM BS-1B.

STEP 7 If possible, describe the composition of the wall assembly, or the R-value (or U-factor), or sketch the section and identify the materials used on the bottom of FORM BS-1B.

STEP 8 If possible, describe the composition of the floor assembly or the R-value (or U-factor), or sketch the section and identify the materials used on the bottom of FORM BS-1B.

EC -- ENERGY AUDIT (BUILDING MEASUREMENT) | GL - I 1.2 | 2

SCALE: X ft. per square. FLOOR PLAN:

ITEM NUMBER AND/OR IDENTIFICATION	DOOR	WINDOW	OPENING	DIAMENSION		GLAZING			STORM SASH	CAULKED	W'STRIPPED	FRAM.		REMARKS
				WIDTH ft.	HEIGHT ft.	SINGLE	DOUBLE	TRIPLE				WOOD	METAL	

PROJECT:

BY:

EC -- ENERGY AUDIT (BUILDING MEASUREMENT)	GL - I 1.2	3

SCALE: X ft. per square. ELEVATION

Roof-ceiling assembly:	Wall assembly:
Floor assembly:	(Specified)

PROJECT:	BY:	

Walkthrough the building by inspect the building elements, parts and spaces for conditions of construction and changes to complete the checklist, CL - 15, provided, rate the problem where "0" indicates the problem is so minor which may be omitted. The walkthough audit process summarys are listed as following:

1. BUILDING ENCLOSURE CHECK FROM EXTERIOR
   - 1.1. Check wall/siding joints for cracks, gaps, and/or missing caulkings.
   - 1.2. Check window/door for broken/missing glass.
   - 1.3. Check window/door for disrepair joints, cracks and missing caulkings.
   - 1.4. Check window/door for poor or missing weatherstrippings.
   - 1.5. Check window/door for unusual openings.
   - 1.6. Inspect all exhaust openings for missing or inoperable back-draft cover or mechanism.
   - 1.7. Note conditions of storm window/door.
   - 1.8. Note building shading condition.
   - 1.9. Note unusual colors and finishing conditions of building surfaces.
2. BUILDING ENCLOSURE CHECK FROM INTERIOR
   - 2.1. Test infiltration for all joints.
   - 2.2. Check all door closure mechanisms.
   - 2.3. Note unusual heat transfer problem.
   - 2.4. Note unusual colors and finishing conditions of walls, ceiling and floor surfaces.
   - 2.5. Note any displacement of wall, ceiling and floor joints.
   - 2.6. Note building shading conditions.
3. INTERIOR SURVEY -- SPACE USE
   - 3.1. Determine any waste space.
   - 3.2. Determine any poor circulation problems.
   - 3.3. Note any space use and egrass problems.
   - 3.4. Note any space use management problems.
   - 3.5. Note any sub-systems integration problems.
   - 3.6. Inspect the effectiveness of natural ventilation.
   - 3.7. Inspect the effectiveness of winter wind breaks.
   - 3.8. Inspect the effectiveness of shading controls.
4. INTERIOR SURVEY -- LIGHTING AND POWER DISTRIBUTION
   - 4.1. Determine any in-efficient lighting sources.
   - 4.2. Determine any useless lightings or lighting with too much footcandles.
   - 4.3. Inspect the effectiveness of lighting controls.
   - 4.4. Inspect the effectiveness of daylighting.
   - 4.5. Inspect the effectiveness of task lighting.
   - 4.6. Note any maintenance problems.
   - 4.7. Note cracks from power line connections.
   - 4.8. Note cracks from wall outlets.
5. INTERIOR SURVEY -- FIREPLACE
   - 5.1. Determine source of combustion air.
   - 5.2. Inspect damper conditions.
   - 5.3. Inspect glass door cinditions.
   - 5.4. Note any waste heat recovery system or device.
   - 5.5. Note any control adjustment for space heating.

6. MECHANICAL SYSTEMS SURVEY -- PLUMBING

   6.1. Check water flow rate of sink faucets.
   6.2. Check water flow rate of shower heads.
   6.3. Check water use capacity of water closets.
   6.4. Check water temperature of hot water outlets.
   6.5. Check all piping insulations.
   6.6. Inspect any water leakage.
   6.7. Note any unusual pipe system distribution and locations.
   6.8. Check water temperature settings of hot water heater/boiler.
   6.9. Check insulation condition of hot water heater/boiler.
   6.10 Check insulation condition of hot-water storage tanks.
   6.11 Check pilot ignition systems.
   6.12 Note any waste heat recovery device.
   6.13 Note any obsolescent equipments.
   6.14 Check exhaust gas condition.
   6.15 Note any maintenance problems.

7. MECHANICAL SYSTEMS SURVEY -- HVAC SYSTEMS

   7.1. Check space temperature and compare with thermostat readings.
   7.2. Check space seasonal temperature settings and note any reset schedules.
   7.3. Check insulation condition of the equipment.
   7.4. Check insulation condition of the delivery systems.
   7.5. Check any leakage from the system.
   7.6. Check any waste heat recovery device.
   7.7. Note any obsolescent equipments.
   7.8. Note any maintenance problems.
   7.9. Inspect all dampers of exhausts and air intakes.
   7.10 Inspect caulkings around joints of exhaust and air intake ducts.

8. SURVEY OF UNHEATED SPACES

   8.1. Check all space air vents.
   8.2. Check insulation condition of adjoining walls, floors and/or partitions.
   8.3. Check manholes, door and exitway conditions of adjoining walls, floors and/or partitions.
   8.4. Check cracks and openings to the adjoining walls, floors and/or partitions.
   8.5. Check insulation condition of piping and duct systems in the unheated spaces.
   8.6. Check cracks and openings from power line connections, lighting fixtures and junction boxes.

9. EXTERIOR SURVEY

   9.1. Check building orientation problems.
   9.2. Check exterior shading devices.
   9.3. Check landscape feature for summer shading and winter wind break.
   9.4. Check solar access (plot the skyline or solar window projection).
   9.5. Inspect the building geometry.
   9.6. Note exterior surface finishings.
   9.7. Note building ground reflectances.

There are basically two ways to reduce energy consumption in a building: one is to eliminate energy waste; and the other one is to change life style. The former, in some cases, requires the assistance of science and technology, and the latter requires only the care of the building occupant, this requires personal commitment to change one's daily practice and possibly sacrifice some comfort and convenience. Also, eliminating waste in many cases, requires financial investment and aplication of newly developed technologies.

The basic energy conservation techniques may be grouped into four types: (A) reducing air infiltration; (B) reducing heat transmission; (c) increasing equipment use efficiency; and (D) reducing energy leaks and Eliminating unnecessary energy use.

(A) Reducing Air Infiltration: In summer, warmer air entering buildings must be cooled, and in winter, cold air entering building must be warmed, either process wastes energy. The basic solution is to stop or reduce the air infiltration by caulking all the cracks around the windows, doors, and joints; weatherstripping windows and doors; closing all openings and vents whenever possible; reduce force air ventilation if possible; and install wind screen by landscaping the site or planning the building groups.

(B) Reducing Heat Transmission: High outdoor temperatures will tranfer heat to the inside in the summer, and the high indoor temperatures will transfer heat to the outside of the building in the winter, either process, again, is wasting energy. The solution is install adequate insulation in roof, walls, and floors; add movable insulation and/or storm doors and windows whenever possible, to reduce heat transmission between the space and the exterior of the building; and provide shading devices to reduce solar exposure in the summer. Indirectly, lower the winter heating temperature and higher the summer cooling temperature will also reducing the heat flow rate.

(C) Increasing Equipment Use Efficiency: Low efficiency equipment uses energy unnecessarily. The solution is to impove the equipment operating efficiency by providing proper maintenance; replacing the equipment with more effient models; reset operating temperature based on demand; reduce or shut-off system in unused spaces; and avoid partial load operating of any equipment and match the size of the equipment iwth the demand.

(D) Reducing Energy Leaks and Eliminating Unnecessary Energy Use: Water and air leaks from pipes, ducts, boiler, etc.; comfort settings are too high; improper use of equipment, excessive ventilation in the heating season, equipment and systems often in use when space is not being used; and the equipment and systems are poorly maintained, all of these are energy wasted. The solution is simply to provide proper and better maintenance; repair and insulate the distribution systems; reset appropriate temperature settings in winter and summer as well as day and night; and reduce or shut off systems when space is not being used.

In addition to the energy conservation techniques, natural energy system may be used to reduce the fuel consumption. Retrofit solar energy systems are possible to existing building and may provide as much as 80% of the energy demand of the building depend on the condition of the existing structure, with even limited application, more than 20% saving is possible.

Passive solar such as direct-gain system where southern oriented windows are enlarged to allow more solar exposure in the winter; or indirect-gain system by adding window to existing southern masonry walls. Active solar such as solar domestic hot water heater may be used as pre-heater to the existing water heater.

JUNE 25, 1979

U.S. DEPARTMENT OF ENERGY
FACULTY DEVELOPMENT SUMMER INSTITUTE
ENERGY CONSERVATION AND ALTERNATE ENERGY SOURCES
at
VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
BLACKSBURG, VIRGINIA 34061

SI-TN-28

PRINCIPLES OF BUILDING ENERGY CONSERVATION -- SUMMARY

RESIDENTIAL ENERGY USES ENERGY CONSERVATION ACTION	SPACE HEATING	WATER HEATING	REFRIGERATION	LIGHTING	COOKING	AIR-CONDITIONING	CLOTHES DRYING	OTHER
%	55.0	14.5	7.7	5.7	5.1	4.6	1.7	5.7
REDUCE OR STOP AIR LEAKS								
caulking								
weatherstripping								
reduce or close opennings								
wind screen by landscape								
REDUCE OR STOP HEAT TRANSMISSIONS								
insulation								
storm window/door and/or airtrap								
reduce winter indoor temperature								
increase summer indoor temperature								
sun screen by landscape								
INCREASE EQUIPMENT USE EFFICIENCY								
annual and/or seasonal maintenance								
plug energy leaks								
- insulate exposed pipes and ducts:								
- stop steam/water leaks from pipes								
- stop air leaks from ducts								
- stop leaks from equipments								
replace low efficient machines								
reduce operating temperature when possible								
reset temperature based on demand								
REDUCE OR STOP EQUIPMENT ENERGY WASTE								
match equipment size with task								
reduce or avoid partial load								
replace obsolete equipment or devices								
turn-off system when space is inactive								
reduce or cut-off exhaust when possible								
APPLY PASSIVE SYSTEMS								
fenestration control								
- natural lighting								
- shading								
- natural ventilation								
time-lag techniques								
- thermal mass/pond								
-thermosyphoning								
APPLY ACTIVE SOLAR SYSTEMS								

CEMEC

Extension Division
Virginia Polytechnic Institute and State University
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TN - 31

Sept. 27, 1978

Community Education Model for Energy Conservation

ENERGY CONSERVATION FOR HOMEOWNER

By Robert N.S. Chiang .
College of Architecture and Urban Studies

TEN ENERGY CONSERVATION TIPS YOU CAN DO WITH LITTLE OR NO COST

1. "CLOSE" all openings to the exterior and to unheated spaces when the space is not in use.
2. Close the exhaust or ventilation dampers in fireplace, and completely cover the fireplace opening, if possible, when not in use.
3. Close or cover all exhaust or ventilation opening of mechanical equipment, in winter, such as window or through-wall air-conditioning units, summer ventilators, etc.
4. Clean all filters in air ducts and surfaces of all radiators; drain sediment and mineral deposits from hot water heater; and adjust all gas burners to produce a cean blue/white flame.
5. Reduce hot water heater to "LOW" temperature setting (120°F if possible, 140°F if dishwasher is used); reduce daytime thermostat setting to 68°F, and to 68°F or lower at night for winter heating; and increase daytime thermostat setting to 72°F or higher, and to 78°F at night for summer cooling.
6. For winter, close all draperies at night and open for sunshine; and, for summer, close at daytime and open for night.
7. Turn-off all power equipment when not in use, and all lights in unused spaces.
8. Have a professional turn-off your gas stove pilot; instead of use matches to light the burners. When purchasing a new gas stove, buy one with electronic ignition.
9. Take short showers, sue less hot water, use water-flow-limiters in hot water faucets, or establish lower flow rates in your faucets.
10. Use home appliances only in "FULL" load condition, and match the size of the appliance with the task.

TEN ENERGY CONSERVATION TECHNIQUES YOU CAN EMPLOY WITH LITTLE OR SOME COST

1. Caulk all cracks around windows, doors, openings, and wall joints, etc.
2. Weatherstrip overlaps, and jonts of windows and doors, etc.
3. Repair small cracks and openings on outside building surfaces; broken glass, and loose frames, etc.
4. Insulate pipes and ducts in unheated basement, attic and crawl spaces.
5. Insulate doors and cover to unheated spaces.
6. Insulate "older" hot water heater.

7. Install attic ventilator for summer cooling, if ceiling is not well insulated.
8. Install galss screen in fireplace opening, and introduce direct outside air to combustion chamber.
9. Repair all indoor system to reduce leakage in air ducts, steam pipes, water faucets, and exhaust dampers, etc.
10. Replace the existing single action thermostat with automatic temperature reduction and night setback control for winter heating.

TEN ENERGY CONSERVATION METHODS YOU MAY PROCESS WITH SOME COST OR LARGE INVESTMENT WHICH REQUIRE ECONOMIC JUSTIFICATION.

1. Add 3½" insulation on top of existing ceiling insulation of 6" or less, or add no more than 6" insulation when existing insulation is less than 3".
2. Insulate floor over vented crawl space with no less than 6"; and over unheated basement with 3" or more.
3. Insulate exterior walls.
4. Install storm doors and windows.
5. Install solar hot water system as pre-heater to the existing water heater.
6. Replace all incandescent lamps by fluorescent lighting if possible.
7. Replace all "out-dated" equipment with higher efficient equipment, such as converted coal furnaces, refrigerators, freezers, hot water heaters, and window air-conditioners, etc.
8. Install new control system to provide individual "ZONE" control for possible reduction of load operation or for complete shut-off when spaces are not in use.
9. Retrofit passive solar systems.
10. Retrofit active solar systems.

Extension Division
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CL - 1

R Sept. 26, 1978

Community Education Model for Energy Conservation

CEMEC

ENERGY AUDIT CHECKLIST FOR HOMEOWNER

By Robert N.S. Chiang, College of Architecture & Urban Studies
Samuel P. Bowen, College of Arts & Sciences

Good energy management implies reducing energy usage by eliminating all unnecessary uses of energy. A checklist is developed, specially for homeowners to establish possibilities of accomplishing energy conservation in and around the house. Every item in this categorized list will not apply to all cases, but the suggested description will provide a more completed energy audit which will systematically guide the user to identify the "energy problems" of homeowner.

Check the "NO" column, if the task in the description has already been accomplished not true, or the item does not apply to the user. If the statement possibly requires some action, circle the "number" in the "YES" column. After completing the audit form, add all the numbers circled in the "YES" column for each page, and add the total on this page to conduct a self-evaluation and make choice for energy conservation actions. The number in the "YES" column is provided to indicate the weight of importance for energy conservation actions, and the relative cost of needed action is indicated by "c" for cost will be very little or nothing to the owner; "$" for some cost (say around $10 to $30); or "$$" for cost requires the owner to consider for a major investment for the house.

		DESCRIPTION	YES	NO	ACTION
EXTERIOR (OUTSIDE)	WINDOWS	1. Glass broken or missing	6		c
		2. Glazing compound or putty in poor condition or missing	4		c
		3. Cracks or gaps around framing	4		c
		4. Loose fitting or can't be tightly closed	8		$$
		5. Storm-window missing or not installed	8		$$
		6. Outside shading or inside curtains missing or inoperable in summer daytime	3		$
		7. Inside shading or curtains missing or inoperable in winter night	3		$
	DOORS	1. Caulking cracks around framing	4		c
		2. Weatherstripping in poor condition or missing	4		c
		3. Threshold in poor condition or missing	3		c
		4. Loose fitting or can't be tightly closed	6		$
		5. Storm-door missing or not installed	4		$
	BLDG. ENCLOSURE	1. Exterior surface material (siding, block, brick, or stucco, etc.) cracks	4		$
		2. Cracks around openings or holes for mail chutes, faucets, wiring conducts, vents, and exhausts, etc.	4		c
		3 Exterior paint blistering or peeling	3		$
		4. Landscape provides little or no shading protection in summer, wind screen or shading of direct sunlight in winter	3		$
TOTAL		SUB-TOTAL THIS PAGE =			
		SUB-TOTAL PAGE 2 =			
		SUB-TOTAL PAGE 3 =			
		SUB-TOTAL PAGE 4 =			
Identification or code No.				= TOTAL ALL PAGES	

ENERGY AUDIT CHECKLIST FOR HOMEOWNER				CL -- 1	P. 2
DESCRIPTION			YES	NO	ACTION
UNHEATED SPACES		1. Attic and crawl-space ventilations closed or obstructed	3		c
		2. Weatherstripping in poor condition or missing from interior access doors to attic, crawl-space, or unheated basement	3		c
		3. attic, crawl-space, or unheated basement access doors missing or not installed	10		$
		4. Insulation in poor condition or missing from interior access doors to attic, crawl-space, or unheated basement	4		$
		5. Cracks around openings or holes for ducts, pipes and wiring passing through ceiling to heated space	3		c
		6. Cracks around recessed lighting fixtures and exhaust fans in ceiling of heated space	3		c
		7. Insulation less than 6 inches in the attic	6		$$
		8. Insulation less than 3½-inches in crawl-space or unheated basement ceilings	6		$$
		9. Insulation on ducts and hot-water or steam pipes in poor condition or missing in unheated space	9		$$
		10. Insulation exterior walls and wall/floor joints in unheated space in poor condition, missing or not installed	4		$$
FIREPLACE		1. Exhaust or ventilation dampers in open position all the time	8		c
		2. Glass screen open or not installed	3		$
		3. Room air used for combustion (no direct outdoor air provide for wood burning)	4		$
		4. Fireplace is constructed from light materials which do not store heat after fire is out	3		$$
		5. Fireplace is located on exterior wall (heat loss to the outside)	3		$$
MECHANICAL EQUIPMENT	WINDOW A/C	1. Window air-conditioning unit exhaust or ventilation dampers in open position all the time	3		c
		2. Cracks around unit	2		c
		3. Unit left uncovered in the winter	4		c
		4 Unit filters or fin-coils dirty or obstructed	3		c
	WATER HEATER	1. Old hot-water heater located in an unheated space without additional insulation around unit	4		$
		2. Heater unit set at higher than 120 degree-F (or higher than 140 degree-F with dishwasher)	4		c
		3. Sediment and mineral deposits in the heater which are not periodically flushed out	3		c
		4. Unit not working as fast as usual (or the unit is not periodically checked or adjusted)	3		$
	H/C SYSTEM	1. System furnace and air-conditioning filter is dirty (not cleaned monthly or replaced seasonally)	3		c
		2. System in use more than a year without servicing	6		$
Identification or code No.				= total this page	

ENERGY AUDIT CHECKLIST FOR HOMEOWNER			CL -- 1		P. 3
		DESCRIPTION	YES	NO	ACTION
MECHANICAL EQUIPMENT	HEATING/COOLING SYSTEMS	3. Burner flame and pilot light show yellow color	4		c
		4. Air leaks around joints of supply and return ducts	3		c
		5. EER (Energy Efficiency Ratios) of air-conditioner less than 8.0	3		$$
		6. Registers and radiators dirty or obstructed by furniture and draperies	3		c
		7. Heat-producing appliances, such as lamps or tv set located near the thermostat	4		c
		8. Doors and windows open to the cutside while heating/cooling system in operation	6		c
		9. Space to dry without humidifier in the winter	2		$
HOME ENERGY MANAGEMENT	LIGHTING	1. Incandescent lights (or long-life type) rather than fluorescent lighting	4		$
		2. Lights on when daylight is adequate or there is no activity in the space	3		c
		3. General lighting rather than lighting for specific tasks	3		$
		4. Exterior decorative lamps are on all the time	3		c
		5. Stereo, television, etc. are on when rooms are not occupied	8		c
	WATER HEATER	1. Water faucets not turned off completely or leaking when not in use	3		c
		2. Faucet pressure too high and water splashes all the time	3		c
		3 Taking baths rather than brief showers	3		c
		4. Water heater unit left on during vacation trips	2		c
	HEATING/COOLING SYSTEMS	1. Daytime thermostat setting more than 65°F in winter; less than 72°F in summer	3		c
		2. Nighttime thermostat setting more than 65°F in winter; less than 78°F in summer	3		c
		3. Air-inlet in space fully open when room is not occupied	3		c
		4. windows and doors closed when natural ventilation is possible for natural cooling	3		c
		5. Draperies closed in daytime and opened at night in the winter; and opened in daytime and closed at night in the summer	3		c
		6. Doors opened to unconditioned space while heating/cooling system is operating	3		c
		7. Doing houseworks during "peak-load" hours	3		c
		8. Changing thermostat setting instead of changing clothes for comfort	3		c
	R/F	1. Refrigerator/freezer has too much empty space (over sized)	1		$
		2. Refrigerator door opened frequently and closed slowly	1		c
		3. Frost built-up in the freezer	1		c
		4. Sweating and icing around refrigerator door	1		c
Identification or code No.				= total this page	

ENERGY AUDIT CHECKLIST FOR HOMEOWNER			CL -- 1		P. 4
		DESCRIPTION	YES	NO	ACTION
HOME ENERGY MANAGEMENT	REFRIGERATOR/FREEZER	5. Hot food containers placed immediately in refrigerator/freezer before brief cooling toward room temperature	1		c
		6. Liquids not covered in refrigerator	1		c
		7. Refrigerator/freezer placed in a warm area or near heat-producing appliances or equipment and/or direct sunlight	1		c
		8. Ventilation around refrigerator/freezer obstructed by furniture or storage	1		c
		9. Condenser coils in rear or bottom of the refrigerator/freezer dirty or obstructed	1		c
		10. Refrigerator temperature unchanged during vacation trips	1		c
		11. Refrigerator shelves over loaded so that cold air can't circulate freely	1		c
		12. Freezer temperature setting too low below freezing	1		c
	COOKING	1. Meat cooked beforeit is thawed	1		c
		2. Pots and pans smaller or larger than burners used	1		c
		3. Cooking with pots and pans uncovered	1		c
		4. High setting and a lot of water used for regular cooking	1		c
		5. Food over cooked	1		c
		6. Gas stove burns with yellow flame	2		c
		7. Range or stove dirty	1		c
		8. Little or no small appliances used instead of range or stove	1		c
		9. Exhaust fan over range or stove inoperative in summer, or on all the time in winter	2		c
		10. Oven used for single dish at a time	1		c
		11. Peeking in oven frequently	1		c
		12. Cracks around oven doors	1		c
		13. Smoke developed from oven	1		c
		14. Foil covering oven racks or containers too close to each other and/or oven walls	1		c
		15. Dishwasher used daily without waiting for full load	2		c
		16. Dishwasher used for complete cycle without open door by air drying	2		c
		17. Dishwasher filter obstructed by deposits	2		c
		18. Rinsing dishes before loading into dishwasher	2		c
	OTHERS	1. Hot water used in food disposer	1		c
		2. Bones, hard foods, Etc. put in disposer	1		c
		3. Ironing done piecemeal rather than a batch	1		c
		4. Clothes washer used without a full load	1		c
		5. Hot water used in clothes washer all the time	1		c
		6. Peeking in clothes dryer frequently	1		c
		7. Lint screen uncleaned after uses	1		c
		8. Driving along during peak traffic time	10		c
		9. Driving large car for short distances	10		c
Identification or code No.				= total this page	

ENERGY CONSERVATION -- ENERGY AUDIT CHECKLIST | TN - 39A | 3

	ITEM IDENTIFICATION OR DESCRIPTION	RATING					NOTES	
		0	1	2	3	4	REMARKS	DOC.
ENCLOSURE FROM EXTERIOR	1.1 Cracks, gaps, and/or missing caulking between joints of walls/siding							
	1.2 Window has missing glass or broken							
	1.3 Window has cracks, missing caulking and/or joints in disrepair							
	1.4 Window has missing weatherstripping or in disrepair							
	1.5 Window has unusual openings (specified)							
	1.6 Door has missing glazing or broken							
	1.7 Door has cracks, missing caulking and/or joints in disrepair							
	1.8 Door has missing weatherstripping or in disrepair							
	1.9 Door has unusual openings (specified)							
	1.10 Exhaust opening (vent) has missing or inoperable back-draft cover or mechanism							
	1.11 Storm window missing or in disrepair							
	1.12 Storm door missing or in disrepair							
	1.13 Exterior shading device missing or in disrepair							
	1.14 Unusual color or finishing condition on exterior walls (specified)							
ENCLOSURE FROM INTERIOR	2.1 Air infiltration from building joints							
	2.2 Air infiltration from window joints and cracks							
	2.3 Air infiltration from door joints and cracks							
	2.4 Door closer mechanism inoperable							
	2.5 Unusual heat transfer problem (specified)							
	2.6 Unusual color or finishing condition on interior walls, ceilings and/or floors (specified)							
	2.7 Noticeable displacement (cracks or out of place) on walls, ceilings and/or floor joints (specified)							
	2.8 Interior shading device missing or in disrepair							

PROJECT:

BY:

DATE:

ENERGY CONSERVATION -- ENERGY AUDIT CHECKLIST	TN - 39A	4

	ITEM IDENTIFICATION OR DESCRIPTION	RATING					NOTES	
		0	1	2	3	4	REMARKS	DOC.
SPACE USE	3.1 Noticeable waste space (specified)							
	3.2 Poor circulation (specified)							
	3.3 Inproper space use (specified)							
	3.4 Poor egrass (specified)							
	3.5 Poor space use management (specified)							
	3.6 Poor sub-systems integration with the building (specified)							
	3.7 Lack of summer natural ventilation							
	3.8 Lack of winter wind breaks							
	3.9 Shading controls are not utilized							
LIGHTING AND POWER DISTRIBUTION	4.1 Inefficient lighting sources (specified)							
	4.2 Useless lighting (specified)							
	4.3 Two much footcandles (specified)							
	4.4 Lack of effective lighting controls (specified)							
	4.5 Lack of effective daylighting (specified)							
	4.6 Daylighting is not utilized (specified)							
	4.7 Lack of effective task lighting (specified)							
	4.8 Noticeable maintenance problem on lighting system (specified)							
FIREPLACE	5.1 Fireplace lack of direct outdoor combustion air							
	5.2 Fireplace damper inoperable							
	5.3 Ineffective or missing fireplace glass doors							
	5.4 Lack of any waste heat recovery system on fireplace							
	5.5 Lack of effective heating control in fireplace space							

PROJECT:	BY:	DATE:	

ENERGY CONSERVATION -- ENERGY AUDIT CHECKLIST	TN - 39A	5

	ITEM IDENTIFICATION OR DESCRIPTION	RATING					NOTES	
		0	1	2	3	4	REMARKS	DOC.
MECHANICAL SYSTEMS -- PLUMBING	6.1 No water flow limiter on sink faucets							
	6.2 No water flow limiter on shower head							
	6.3 Inefficient water closets							
	6.4 High hot water supply temperature							
	6.5 Pipe insulation missing or in disrepair							
	6.6 Noticeable water leakage (specified)							
	6.7 Piping system too long (specified)							
	6.8 Hot water heater/boiler temperature setting too high (specified)							
	6.9 Insufficient insulation on hot water heater/boiler							
	6.10 Insufficient insulation on hot water storage tank							
	6.11 In-efficient pilot ignition system							
	6.12 Lack of waste heat recovery system or exhaust system							
	6.13 Inefficient hot water heater/boiler							
	6.14 Lack of proper maintenance (specified)							
MECHANICAL SYSTEMS -- HVAC	7.1 Thermostat reading is not compatable with the space temperature							
	7.2 Winter space temperature setting is higher then 65°F							
	7.3 Summer space temperature setting is lower than 75°F							
	7.4 Lack of night setback							
	7.5 Insulation on HVAC equipment missing or in disrepair (specified)							
	7.6 Insulation on HVAC delivery systems missing or in disrepair							
	7.7 Noticeable leakage from HVAC systems (specified)							

PROJECT:	BY:	DATE:	

ENERGY CONSERVATION -- ENERGY AUDIT CHECKLIST | TN - 39A | 6

	ITEM IDENTIFICATION OR DESCRIPTION	RATING	NOTES	
		01234	REMARKS	DOC.
HVAC SYSTEMS	7.8 Lack of waste heat recovery system from the HVAC exhaust systems			
	7.9 Inproper adjusted damper on exhaust systems			
	7.10 Inproper adjusted damper on frash-air intake			
	7.11 Inefficient HVAC equipment (specified)			
	7.12 Lack of proper maintenance on HVAC systems (specified)			
UNHEATED SPACE	8.1 Lack of proper control on air vents in unheated spaces (specified)			
	8.2 Lack of insulation on adjoining wall, floor or/and partitions in unheated space (specified)			
	8.3 Lack of insulation on adjoining door or exitway to the heated space from an unheated space (specified)			
	8.4 Cracks and openings on adjoining wall, floor or/and partitions in the unheated space (specified)			
	8.5 Lack of insulation on pipes and ducts in the unheated space (specified)			
EXTERIOR	9.1 The major orientation of the building is not due south			
	9.2 Lack of summer landscape shading			
	9.3 Lack of winter landscape wind breaks			
	9.4 Lack of solar access (specified)			
	9.5 Lack of ground reflection			
	0.1 System in operation when space is unused (specified)			
	0.2 Equipment in use with partial load (specified)			
	0.3 Inappropriate energy source (specified)			
	0.4 Lack of solar energy utilization (specified)			

PROJECT:

BY:

DATE:

- 1

Good energy management implies reducing energy usage by eliminating all unnecessary uses of energy. A checklist is developed, specially for homeowners to establish possibilities of accomplishing energy conservation in and around the house. Every item in this categorized list will not apply to all cases, but the suggested description will provide a more completed energy audit which will systematically guide the user to identify the "energy problems" of homeowner.

Check the "NO" column, if the task in the description has already been accomplished not true, or the item does not apply to the user. If the statement possibly requires some action, circle the "number" in the "YES" column. After completing the audit form, add all the numbers circled in the "YES" column for each page, and add the total on this page to conduct a self-evaluation and make choice for energy conservation actions. The number in the "YES" column is provided to indicate the weight of importance for energy conservation actions, and the relative cost of needed action is indicated by "c" for cost will be very little or nothing to the owner; "$" for some cost (say around $10 to $30); or "$$" for cost requires the owner to consider for a major investment for the house.

		DESCRIPTION	YES	NO	ACTION
EXTERIOR (OUTSIDE)	WINDOWS	1. Glass broken or missing	6		c
		2. Glazing compound or putty in poor condition or missing	4		c
		3. Cracks or gaps around framing	4		c
		4. Loose fitting or can't be tightly closed	8		$$
		5. Storm-window missing or not installed	8		$$
		6. Outside shading or inside curtains missing or inoperable in summer daytime	3		$
		7. Inside shading or curtains missing or inoperable in winter night	3		$
	DOORS	1. Caulking cracks around framing	4		c
		2. Weatherstripping in poor condition or missing	4		c
		3. Threshold in poor condition or missing	3		c
		4. Loose fitting or can't be tightly closed	6		$
		5. Storm-door missing or not installed	4		$
	BLDG. ENCLOSURE	1. Exterior surface material (siding, block, brick, or stucco, etc.) cracks	4		$
		2. Cracks around openings or holes for mail chutes, faucets, wiring conducts, vents, and exhausts, etc.	4		c
		3 Exterior paint blistering or peeling	3		$
		4. Landscape provides little or no shading protection in summer, wind screen or shading of direct sunlight in winter	3		$
TOTAL		SUB-TOTAL THIS PAGE =			
		SUB-TOTAL PAGE 2 =			
		SUB-TOTAL PAGE 3 =			
		SUB-TOTAL PAGE 4 =			
Identification or code No.				= TOTAL ALL PAGES	

ENERGY AUDIT CHECKLIST FOR HOMEOWNER			CL -- 1		P. 2
		DESCRIPTION	YES	NO	ACTION
UNHEATED SPACES		1. Attic and crawl-space ventilations closed or obstructed	3		c
		2. Weatherstripping in poor condition or missing from interior access doors to attic, crawl-space, or unheated basement	3		c
		3. attic, crawl-space, or unheated basement access doors missing or not installed	10		$
		4. Insulation in poor condition or missing from interior access doors to attic, crawl-space, or unheated basement	4		$
		5. Cracks around openings or holes for ducts, pipes and wiring passing through ceiling to heated space	3		c
		6. Cracks around recessed lighting fixtures and exhaust fans in ceiling of heated space	3		c
		7. Insulation less than 6 inches in the attic	6		$$
		8. Insulation less than 3½-inches in crawl-space or unheated basement ceilings	6		$$
		9. Insulation on ducts and hot-water or steam pipes in poor condition or missing in unheated space	9		$$
		10. Insulation exterior walls and wall/floor joints in unheated space in poor condition, missing or not installed	4		$$
FIREPLACE		1. Exhaust or ventilation dampers in open position all the time	8		c
		2. Glass screen open or not installed	3		$
		3. Room air used for combustion (no direct outdoor air provide for wood burning)	4		$
		4. Fireplace is constructed from light materials which do not store heat after fire is out	3		$$
		5. Fireplace is located on exterior wall (heat loss to the outside)	3		$$
MECHANICAL EQUIPMENT	WINDOW A/C	1. Window air-conditioning unit exhaust or ventilation dampers in open position all the time	3		c
		2. Cracks around unit	2		c
		3. Unit left uncovered in the winter	4		c
		4 Unit filters or fin-coils dirty or obstructed	3		c
	WATER HEATER	1. Old hot-water heater located in an unheated space without additional insulation around unit	4		$
		2. Heater unit set at higher than 120 degree-F (or higher than 140 degree-F with dishwasher)	4		c
		3. Sediment and mineral deposits in the heater which are not periodically flushed out	3		c
		4. Unit not working as fast as usual (or the unit is not periodically checked or adjusted)	3		$
	H/C SYSTEM	1. System furnace and air-conditioning filter is dirty (not cleaned monthly or replaced seasonally)	3		c
		2. System in use more than a year without servicing	6		$
Identification or code No.				= total this page	

ENERGY AUDIT CHECKLIST FOR HOMEOWNER — CL -- 1 — P. 3

		DESCRIPTION	YES	NO	ACTION
MECHANICAL EQUIPMENT	HEATING/COOLING SYSTEMS	3. Burner flame and pilot light show yellow color	4		c
		4. Air leaks around joints of supply and return ducts	3		c
		5. EER (Energy Efficiency Ratios) of air-conditioner less than 8.0	3		$$
		6. Registers and radiators dirty or obstructed by furniture and draperies	3		c
		7. Heat-producing appliances, such as lamps or tv set located near the thermostat	4		c
		8. Doors and windows open to the outside while heating/cooling system in operation	6		c
		9. Space to dry without humidifier in the winter	2		$
HOME ENERGY MANAGEMENT	LIGHTING	1. Incandescent lights (or long-life type) rather than fluorescent lighting	4		$
		2. Lights on when daylight is adequate or there is no activity in the space	3		c
		3. General lighting rather than lighting for specific tasks	3		$
		4. Exterior decorative lamps are on all the time	3		c
		5. Stereo, television, etc. are on when rooms are not occupied	8		c
	WATER HEATER	1. Water faucets not turned off completely or leaking when not in use	3		c
		2. Faucet pressure too high and water splashes all the time	3		c
		3. Taking baths rather than brief showers	3		c
		4. Water heater unit left on during vacation trips	2		c
	HEATING/COOLING SYSTEMS	1. Daytime thermostat setting more than 65°F in winter; less than 72°F in summer	3		c
		2. Nighttime thermostat setting more than 65°F in winter; less than 78°F in summer	3		c
		3. Air-inlet in space fully open when room is not occupied	3		c
		4. windows and doors closed when natural ventilation is possible for natural cooling	3		c
		5. Draperies closed in daytime and opened at night in the winter; and opened in daytime and closed at night in the summer	3		c
		6. Doors opened to unconditioned space while heating/cooling system is operating	3		c
		7. Doing houseworks during "peak-load" hours	3		c
		8. Changing thermostat setting instead of changing clothes for comfort	3		c
	R/F	1. Refrigerator/freezer has too much empty space (over sized)	1		$
		2. Refrigerator door opened frequently and closed slowly	1		c
		3. Frost built-up in the freezer	1		c
		4. Sweating and icing around refrigerator door	1		c
Identification or code No.				= total this page	

ENERGY AUDIT CHECKLIST FOR HOMEOWNER	CL -- 1	P. 4

		DESCRIPTION	YES	NO	ACTION
HOME ENERGY MANAGEMENT	REFRIGERATOR/FREEZER	5. Hot food containers placed immediately in refrigerator/freezer before brief cooling toward room temperature	1		c
		6. Liquids not covered in refrigerator	1		c
		7. Refrigerator/freezer placed in a warm area or near heat-producing appliances or equipment and/or direct sunlight	1		c
		8. Ventilation around refrigerator/freezer obstructed by furniture or storage	1		c
		9. Condenser coils in rear or bottom of the refrigerator/freezer dirty or obstructed	1		c
		10. Refrigerator temperature unchanged during vacation trips	1		c
		11. Refrigerator shelves over loaded so that cold air can't circulate freely	1		c
		12. Freezer temperature setting too low below freezing	1		c
	COOKING	1. Meat cooked beforeit is thawed	1		c
		2. Pots and pans smaller or larger than burners used	1		c
		3. Cooking with pots and pans uncovered	1		c
		4. High setting and a lot of water used for regular cooking	1		c
		5. Food over cooked	1		c
		6. Gas stove burns with yellow flame	2		c
		7. Range or stove dirty	1		c
		8. Little or no small appliances used instead of range or stove	1		c
		9. Exhaust fan over range or stove inoperative in summer, or on all the time in winter	2		c
		10. Oven used for single dish at a time	1		c
		11. Peeking in oven frequently	1		c
		12. Cracks around oven doors	1		c
		13. Smoke developed from oven	1		c
		14. Foil covering oven racks or containers too close to each other and/or oven walls	1		c
		15. Dishwasher used daily without waiting for full load	2		c
		16. Dishwasher used for complete cycle without open door by air drying	2		c
		17. Dishwasher filter obstructed by deposits	2		c
		18. Rinsing dishes before loading into dishwasher	2		c
	OTHERS	1. Hot water used in food disposer	1		c
		2. Bones, hard foods, Etc, put intdisppoer in [illegible]	1		c
		3. Ironing done piecemeal rather than a batch	1		c
		4. Clothes washer used without a full load	1		c
		5. Hot water used in clothes washer all the time	1		c
		6. Peeking in clothes dryer frequently	1		c
		7. Lint screen uncleaned after uses	1		c
		8. Driving along during peak traffic time	10		c
		9. Driving large car for short distances	10		c
Identification or code No.				= total this page	

Vocabulary Worksheet

1. energy
2. energy conservation
3. alternative energy
4. solar energy
5. wind power
6. geothermal energy
7. underground dwelling
8. passive solar systems
9. active solar systems
10. biomass energy
11. nuclear energy
12. energy audit

TEST

Unit 4: Energy Conservation

Directions: Read each statement carefully. Select the word or phrase that correctly answers or completes the statement, and write the appropriate letter in the blank.

Example: __A__ 21. The class that you are in is—
A. Industrial Arts
B. Health
C. Science
D. Math

___ 1. The type of energy that can be passive or active and is produced from the sun's rays is—
A. geothermal
B. solar
C. wind
D. nuclear

___ 2. The type of energy produced from heat inside the earth is—
A. solar
B. wind
C. geothermal
D. nuclear

___ 3. The technique used to survey buildings to determine energy consumption is a(n)—
A. energy audit
B. construction survey
C. route survey
D. building survey

___ 4. Most energy conservation techniques can be done with—
A. little or no cost
B. little or some cost
C. some cost or a large justified investment
D. all of the above

___ 5. Energy produced from burning wood is—
A. biomass
B. solar
C. nuclear
D. geothermal

___ 6. The type of energy produced by splitting atoms is—
A. biomass
B. solar
C. nuclear
D. geothermal

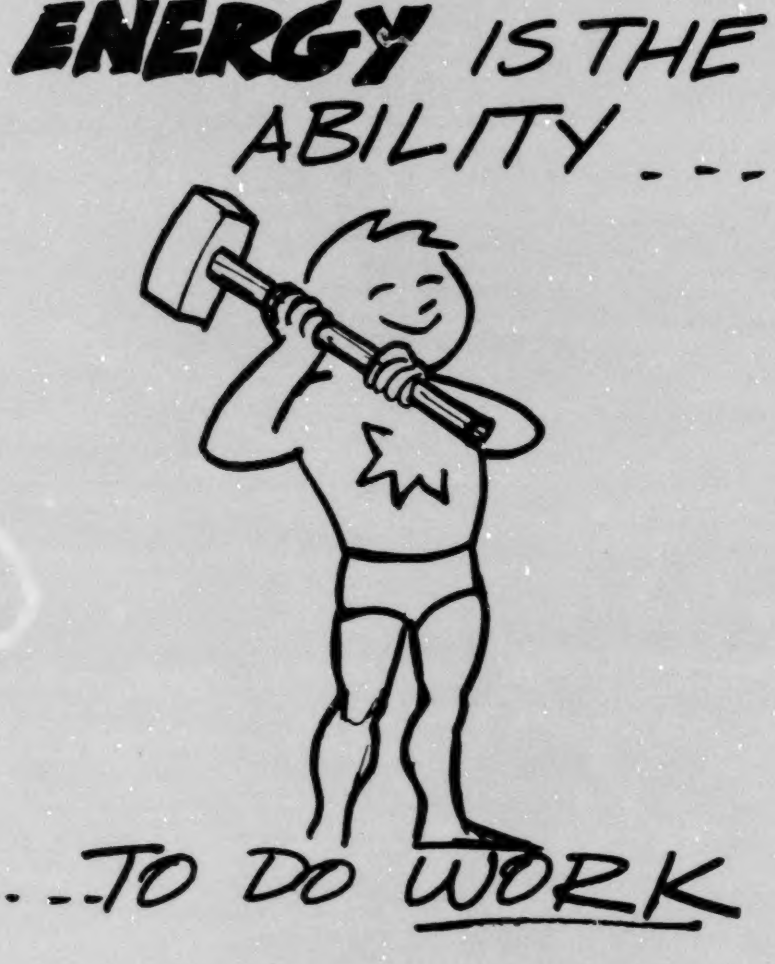
___ 7. The type of solar system that collects and delivers the stored heat to any part of the house or building when it is needed is—
A. passive
B. active
C. retroactive
D. biomass

___ 8. Which of the following is an energy conservation technique?
1. reducing air infiltration
2. reducing heat transmission
3. increasing equipment efficiency
4. all of the above

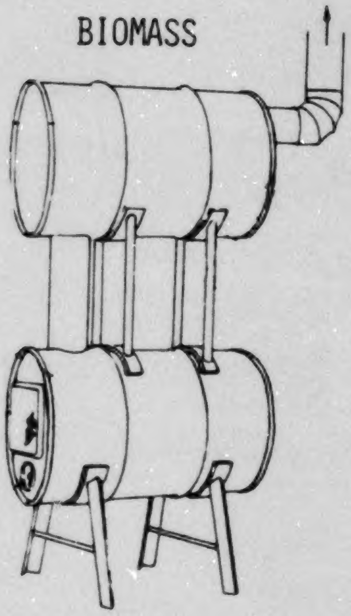
___ 9. To conserve energy, the hot water temperature setting should be lowered to—
A. 120°F
B. 140°F
C. 160°F
D. 180°F

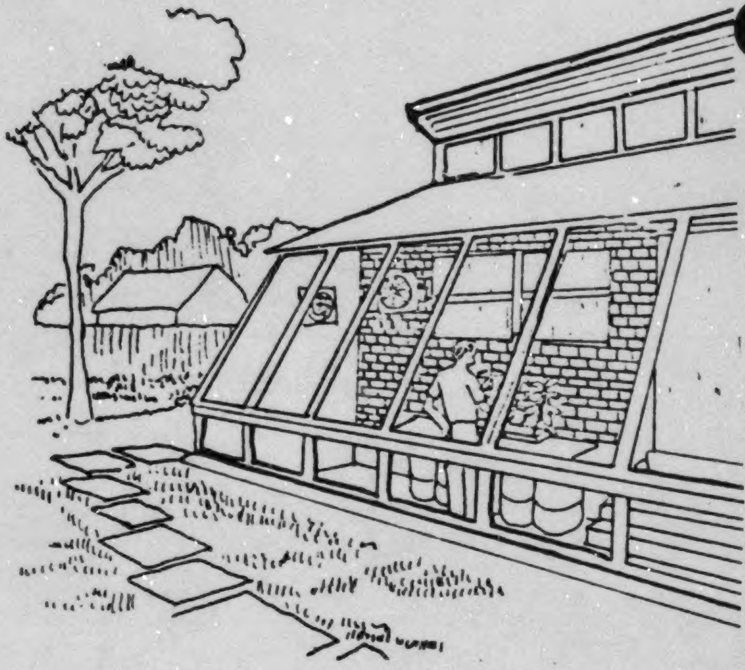
___ 10. The type of energy that was commonly used on farms in the U. S. many years ago is—
A. geothermal
B. solar
C. wind
D. nuclear

WHAT IS ENERGY?


ENERGY IS THE ABILITY - - -
. . . TO DO WORK

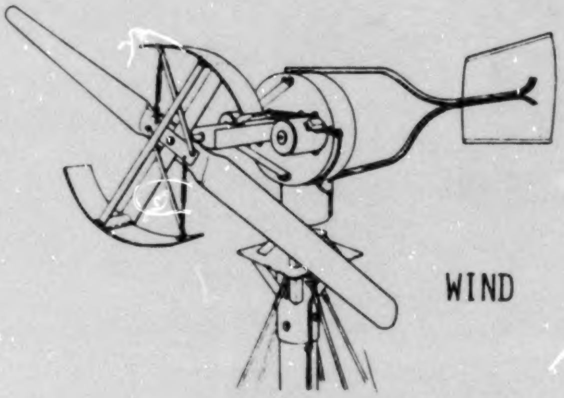
BIOMASS



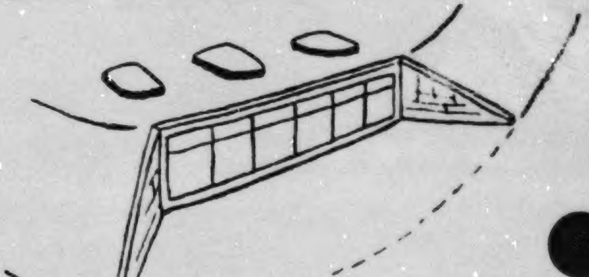


SOLAR

ENERGY CONSERVATION TECHNIQUES

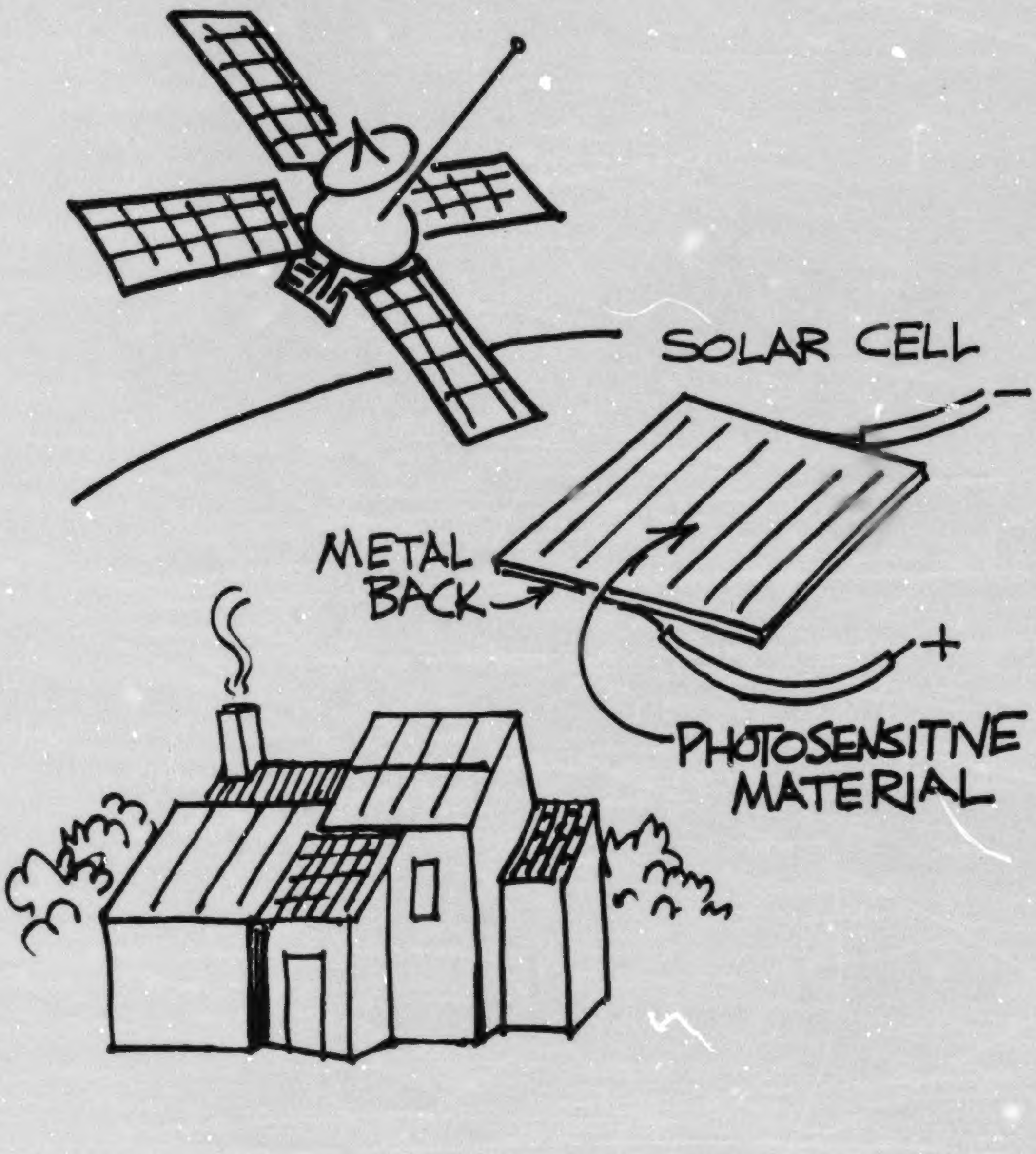


WIND

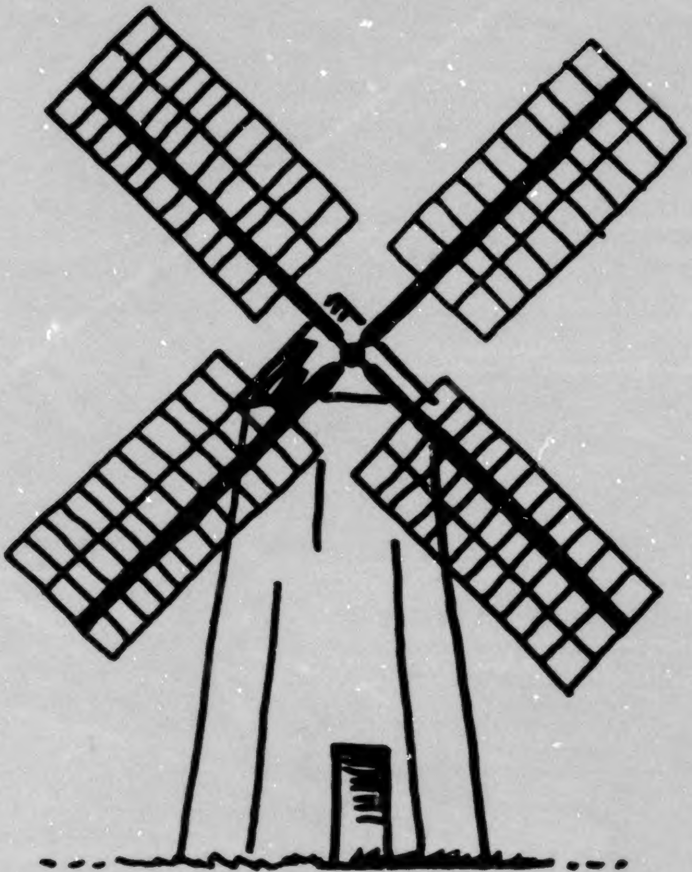


UNDERGROUND

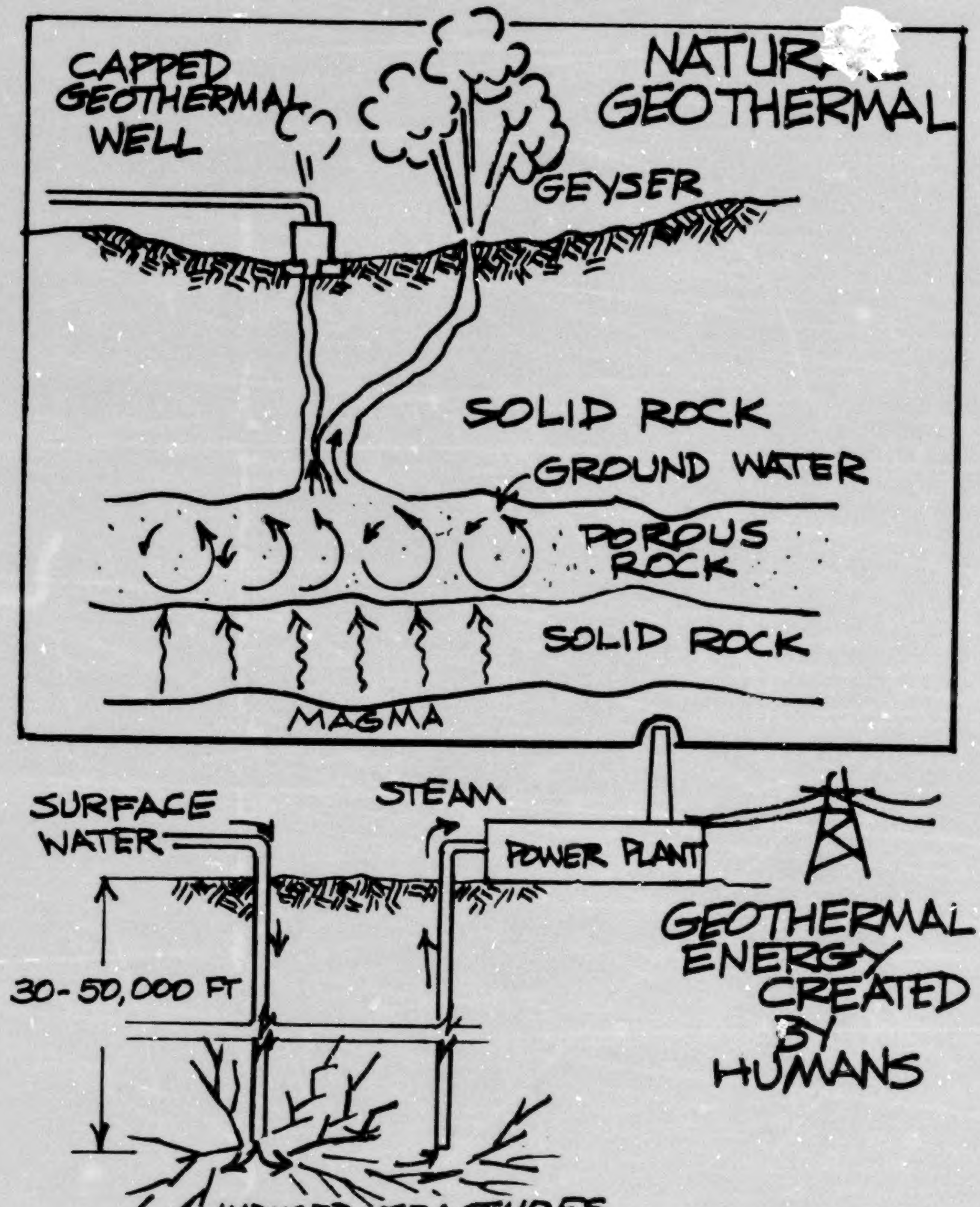
SOLAR ENERGY AS AN ALTERNATIVE


SOLAR CELL
−
METAL BACK
+
PHOTOSENSITIVE MATERIAL

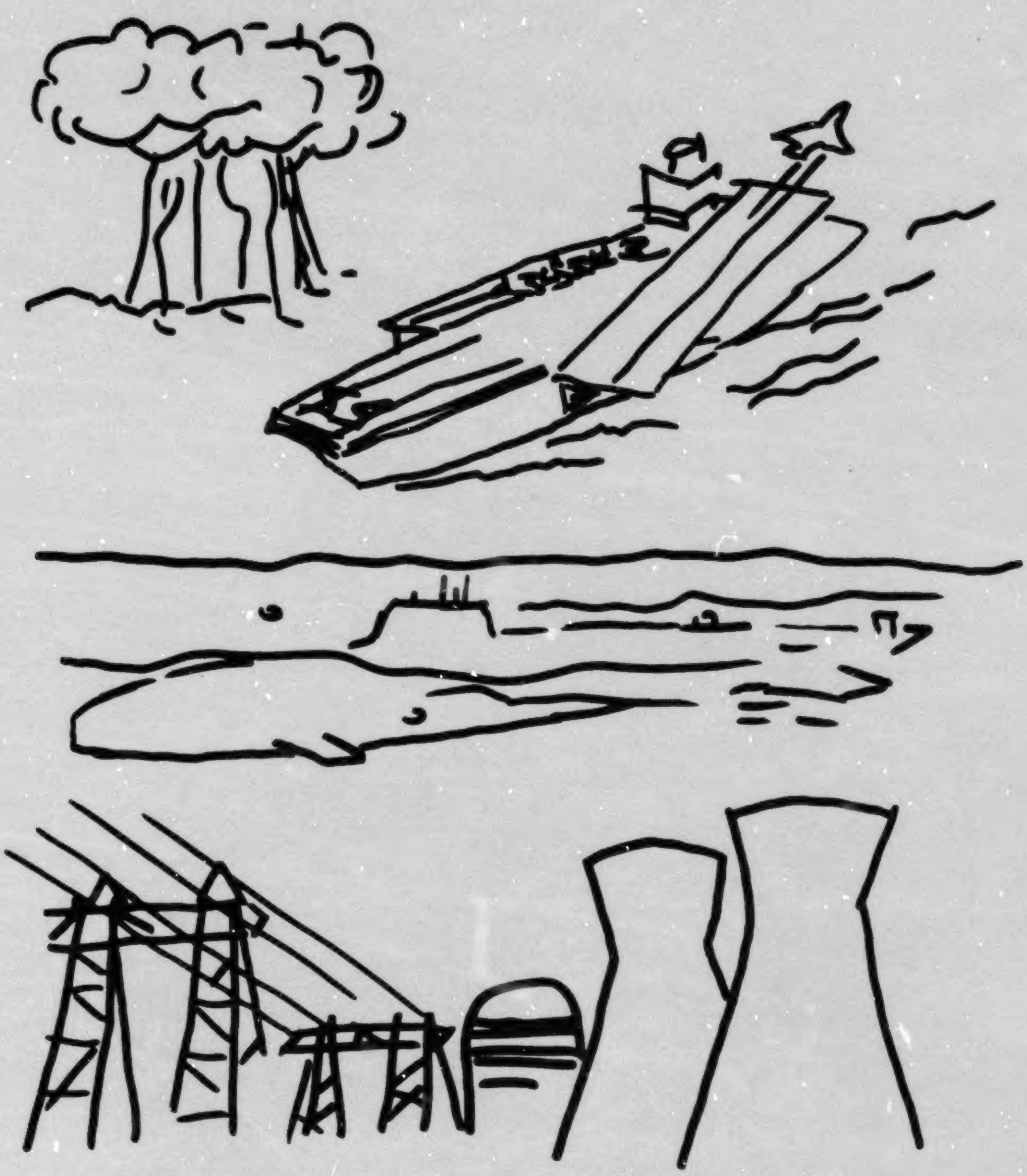
WIND POWER



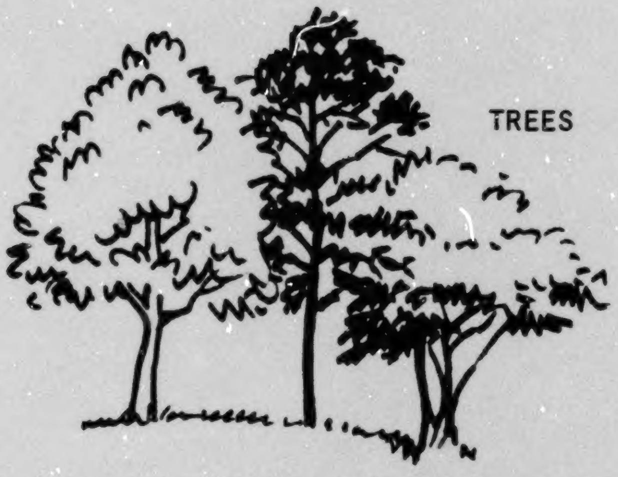
GEOTHERMAL ENERGY

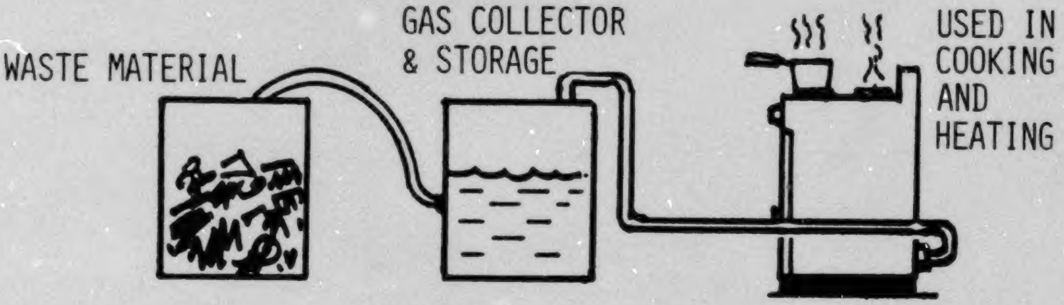

CAPPED GEOTHERMAL WELL
NATURAL GEOTHERMAL
GEYSER
SOLID ROCK
GROUND WATER
POROUS ROCK
SOLID ROCK
MAGMA
SURFACE WATER
STEAM
POWER PLANT
30-50,000 FT
GEOTHERMAL ENERGY CREATED BY HUMANS
INDUCED FRACTURES

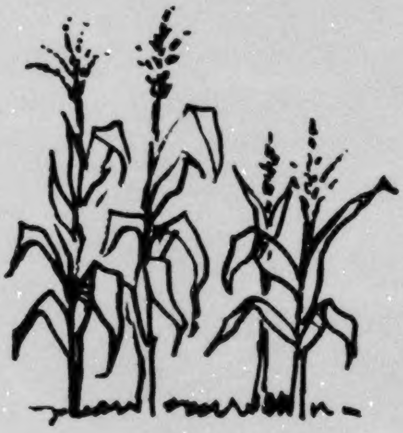
NUCLEAR ENERGY



BIOMASS ENERGY SOURCES




WASTE MATERIAL
GAS COLLECTOR & STORAGE
USED IN COOKING AND HEATING
METHANE GAS


GRAIN CROPS

5

Construction

OBJECTIVES

After the students have covered the material in this unit, they should be able to—

1. describe and be able to give examples of what is involved in contracting;
2. relate the process involved in preparing to build a structure;
3. identify and give examples of residential, commercial, and civil construction structures;
4. describe and be able to give examples of subcontracting; and
5. demonstrate the principles and concepts of entrepreneurship.

KEY WORDS: VOCABULARY

The words in the following list may be new to the students studying construction. Teachers should help students understand these words as they are used in this topic of study.

contracting
subcontracting
entrepreneurship
balloon framing
platform framing
plank and beam framing
skeleton framing
curtain-wall framing
cantilevered framing
bearing-wall framing

TEACHING AIDS

- Overhead projector
- Appendices A and B
- Test Key: 1-C, 2-A, 3-D, 4-C, 5-B, 6-D, 7-A, 8-C, 9-B, 10-D
- Transparencies: You will find transparencies C5-1 through C5-10 at the end of this unit. If you wish, these masters may be duplicated in quantity and given as handouts to the students while they are studying the different aspects of this unit.

C5-1: Contracting
C5-2: Clearing the Site
C5-3: Balloon Framing
C5-4: Platform Framing
C5-5: Plank and Bean Framing
C5-6: Skeleton Framing
C5-7: Beaming Wall
C5-8: Curtain-wall
C5-9: Cantilevered Framing
C5-10: Entrepreneurship

SUGGESTED REFERENCES

Bame, E. A., and Cummings, P. Exploring Technology. Worchester, Mass.: Davis Publications, 1980.

Betts, M. Roger; Hausenstein, A. Dean; and Fannin, John. Exploring the Construction Industry. Bloomington, Ill.: McKnight Publishing Company, 1976.

Helper, Donald E., and Wallach, Paul I. Architecture Drafting and Design. New York: McGraw-Hill Book Company, 1977.

Huth, Mark. Introduction to Construction. Albany, N. Y.: Delmar Publications, 1980.

Landers, Jack M. Construction Materials, Methods, Careers. South Holland, Ill.: Goodheart-Willcox Company, 1983.

Lux, Donald G.; Ray, Willis E.; Blankenbaker, E. Keith; and Umstattd, William. World of Construction. Bloomington, Ill.: McKnight Publishing Company, 1982.

Wyatt, William E. General Architectural Drawing. Peoria, Ill.: Charles A. Bennett Company, 1976.

SENTENCE OUTLINE

I. Contracting (Transparency C5-1)
  A. Contracting involves the following processes:
    1. advertising for bids
    2. estimating
    3. bid proposal
    4. opening and awarding bid
    5. bonding procedures
    6. notifying the start of the project
  B. The contractor has certain responsibilities toward the completion of the project:
    1. supplying all materials and labor for the project
    2. subcontracting certain jobs of the project, if necessary
    3. working with the architect to make sure that all plans, specifications, safety regulations, labor laws, and so on are met
    4. seeing that the job gets done on time with quality workmanship
  C. Clearing the site included the following activities: (Transparency C5-2)
    1. demolishing
    2. earthwork
    3. salvage
    4. cutting and burning
    5. disposing
  D. Setting up temporary facilities includes—
    1. setting up the field office and sanitary facilities;
    2. seeing that all the materials and supplies are delivered and stored properly;
    3. seeing that all the equipment is moved to the site; and
    4. seeing that all temporary utilities are installed.
  E. Earthwork is necessary—
    1. to provide access roads on the construction site;
    2. to shape the terrain so that foundations and footings can be erected;
    3. to divert water for bridges and dam construction;
    4. to reshape the terrain for roadways, railways, tunnels, and so on;
    5. to backfill; and
    6. to landscape.

II. Structures
  A. Footing and foundations are the support of all structures.
  B. The footing distributes the weight of the structure evenly over the entire structure.
  C. The foundation supports the structure's entire weight.
  D. Types of residential structures
    1. Balloon framing (Transparency C5-3)
      a. Studs run continuous to the roof, supporting second-floor joists.
      b. The major advantage of balloon framing is its dimensional stability.
      c. The major disadvantage of balloon framing is notching the studs for ribboning, and the studs must be constructed at the same time as the floor joist.

2. Platform framing (Transparency C5-4)
    a. This is one story built one on top of the other, tied together by a soleplate and a top plate.
    b. The major advantage of platform framing is that it lends itself well to wall sections being built off-site and being transported to the site where they are erected.
    c. The major disadvantage of platform framing is that the lumber shrinks across the grain.
3. Plank and beam framing (Transparency C5-5)
    a. It uses a beam support system, with all beams spaced 6 to 8 feet apart.
    b. The major advantage of plank and beam framing is that it reduces cost because of using fewer materials.
    c. The major disadvantage of plank and beam framing is that additional support or shoring is usually needed where heavy loads are to be located.

E. Types of commercial framing
    1. **Skeleton framing.** A frame supports the structure, and the walls that only serve to enclose areas are nonload bearing.
    2. **Bearing-wall framing.** The wall supports the structure. (Transparency C5-7)
    3. **Curtain-wall framing.** It is a nonload-bearing frame that only encloses a space. (Transparency C5-8)
    4. **Cantilevered framing.** It is a type of framing that is only supported on one end and is used for decks, overhangs, and so forth. (Transparency C5-9)

F. Types of civil structures
    1. bridges
        a. beam (girder, truss, and cantilever)
        b. arch
        c. suspension
    2. dams and canals
    3. roadways
    4. railways

III. Subcontracting
    A. Installing circulatory systems including designing and installing—
        1. plumbing systems;
        2. electrical systems;
        3. heating, air conditioning, and ventilating systems;
        4. security systems; and
        5. energy conservation systems.
    B. Completing the structure includes—
        1. installing drywall and plaster walls;
        2. installing interior trim and molding;
        3. installing floor coverings, wall coverings, and so on; and
        4. installing fixtures and furnishings.

IV. Entrepreneurship (Transparency C5-10)
    A. Three types of ownership
        1. Sole proprietorship refers to a single person owning a business.
        2. Partnership refers to several people owning a business together.
        3. A corporation exists when shares of stock are sold to individuals and these individuals act as one to operate the business.
    B. All companies are organized in a certain hierarchical structure, with various line and staff functions and responsibilities.
    C. Entrepreneurship requires the functions of planning, organizing, controlling, and directing construction workers and activities.
    D. It requires exploring the feasibility of building various structures.
    E. Financing the project, advertising it, and marketing it to make a profit make up an important phase of entrepreneurship.

F. Securing and training construction workers for the project is a vital part of entrepreneurship.
G. Scheduling workers and routing materials for the job is a major responsibility to the overall success of the project. Seeing that it is completed on time, with good workmanship, is another.

MATERIALS FOR STUDENTS

- Vocabulary worksheet
- Student activities

SUGGESTED STUDENT ACTIVITIES

1. Identify a site, determine the obstacles to be removed, determine the best way to remove the obstacles, and locate a structure on the site using surveying equipment.
2. Have a select group of students videotape earth-moving equipment that is performing various clearing operations, and show it to the class.
3. Have students participate in a school service project in conjunction with the local AIASA chapter which requires footing and foundation work. Have students prepare the footings and foundation, form it, pour it, then remove the frames. An example of this would be the footing and foundation work for a school entrance sign.
4. Have students construct masonry work for activity 3.
5. Have an architect or contractor talk to class about the different types of residential and commercial framing. A select group of students can videotape examples of each type of framing, which can be shown at the same time.
6. Have students organize themselves into groups. Each group is responsible for constructing a model of one type of framing.
7. Have a representative from the state highway department or corps of engineers talk to the class about the different types of civil construction. A select group of students can videotape examples of each type of construction, which can be shown at the same time.
8. Have students design and construct, of their choice, a residential construction model, a commercial construction model, or a civil construction model.
9. For an entrepreneurship activity, have students design and construct dollhouses to be advertised and marketed. The profit can be used to pay AIASA dues or for some other AIASA activity.
10. Have students design and construct a toolshed. The toolshed can be precontracted with someone in the community, or it can be designed for a specific school or community purpose. This activity could be designed for an AIASA fund-raising activity.

Vocabulary Worksheet

1. contracting

2. subcontracting

3. entrepreneurship

4. balloon framing

5. platform framing

6. plank and beam framing

7. skeleton framing

8. curtain-wall framing

9. cantilevered framing

10. bearing-wall framing

TEST

Unit 5: Conservation

Directions: Read each statement carefully. Select the word or phrase that correctly answers or completes the statement, and write the appropriate letter in the blank.

Example: B 21. The class that you are in is—
A. Health
B. Industrial Arts
C. Science
D. Math

___ 1. The item that distributes the weight of the structure evenly over the entire structure is the—
A. joist
B. header
C. footing
D. foundation

___ 2. The entire weight of the structure is supported by the—
A. foundation
B. footing
C. header
D. joist

___ 3. An example of clearing the site is—
A. demolishing
B. salvaging
C. disposing
D. all of the above

___ 4. The type of framing in which the studs run continuous to the roof is—
A. platform
B. plank and beam
C. balloon
D. cantilevered

___ 5. The type of framing that is tied together by a soleplate and a top plate is—
A. cantilevered
B. platform
C. balloon
D. plank and beam

___ 6. The type of framing that uses a support system with beams spaced 6 to 8 feet apart is—
A. balloon
B. platform
C. cantilevered
D. plank and beam

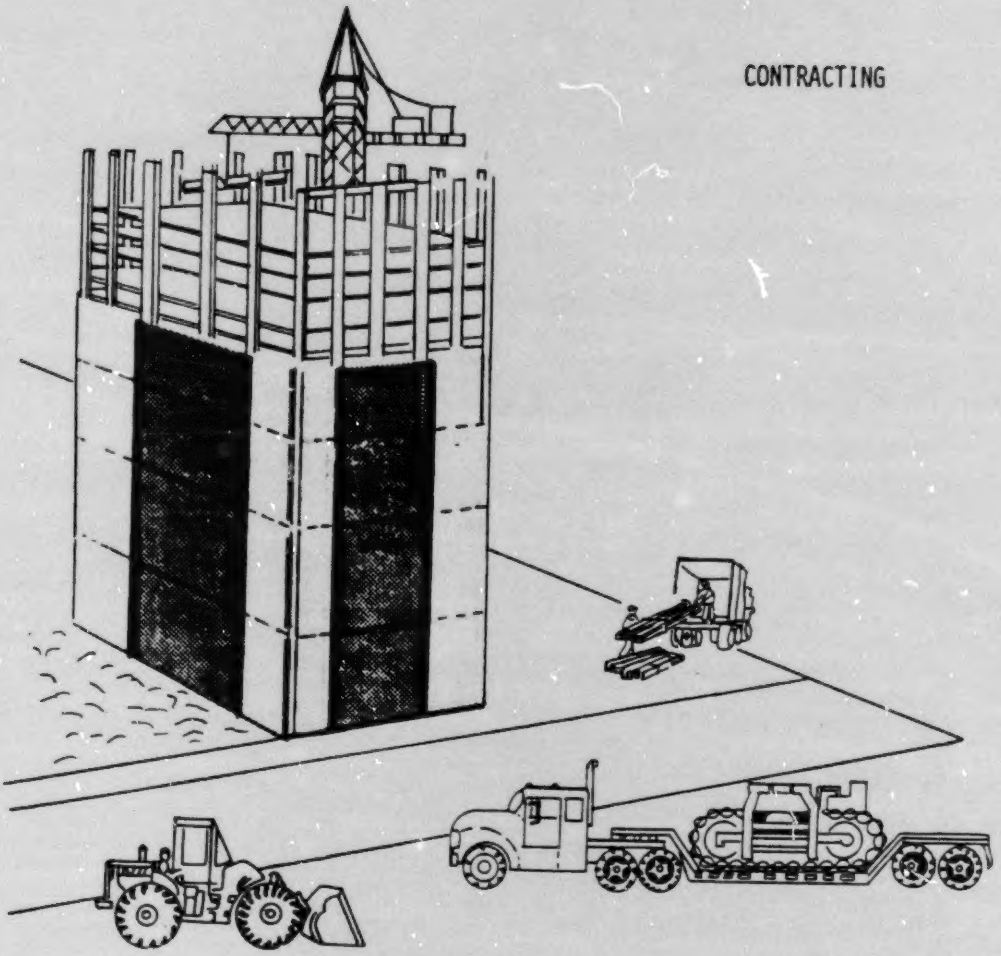
___ 7. The type of framing that has nonload-bearing walls and a frame supporting the structure is—
A. skeleton
B. curtain-wall
C. bearing-wall
D. cantilevered

___ 8. The type of framing in which walls support the structure is—
A. skeleton
B. curtain-wall
C. bearing-wall
D. cantilevered

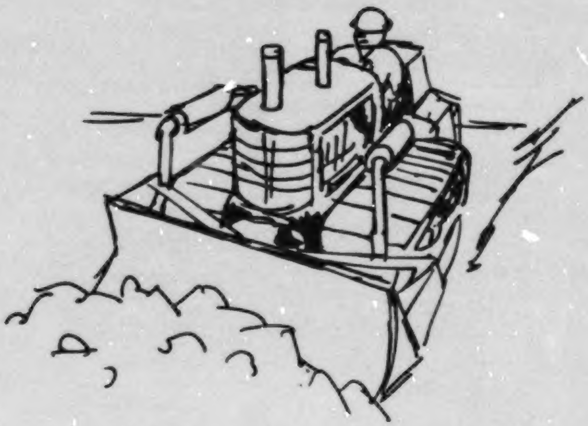
___ 9. The type of framing that has a nonload-bearing frame that only encloses a space is—
A. bearing-wall
B. curtain-wall
C. cantilevered
D. skeleton

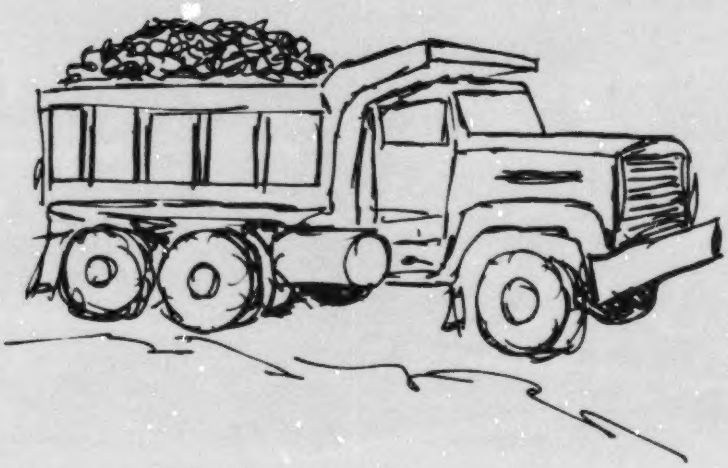
___ 10. The type of framing only supported on one end is—
A. skeleton
B. bearing-wall
C. curtain-wall
D. cantilevered

CONTRACTING

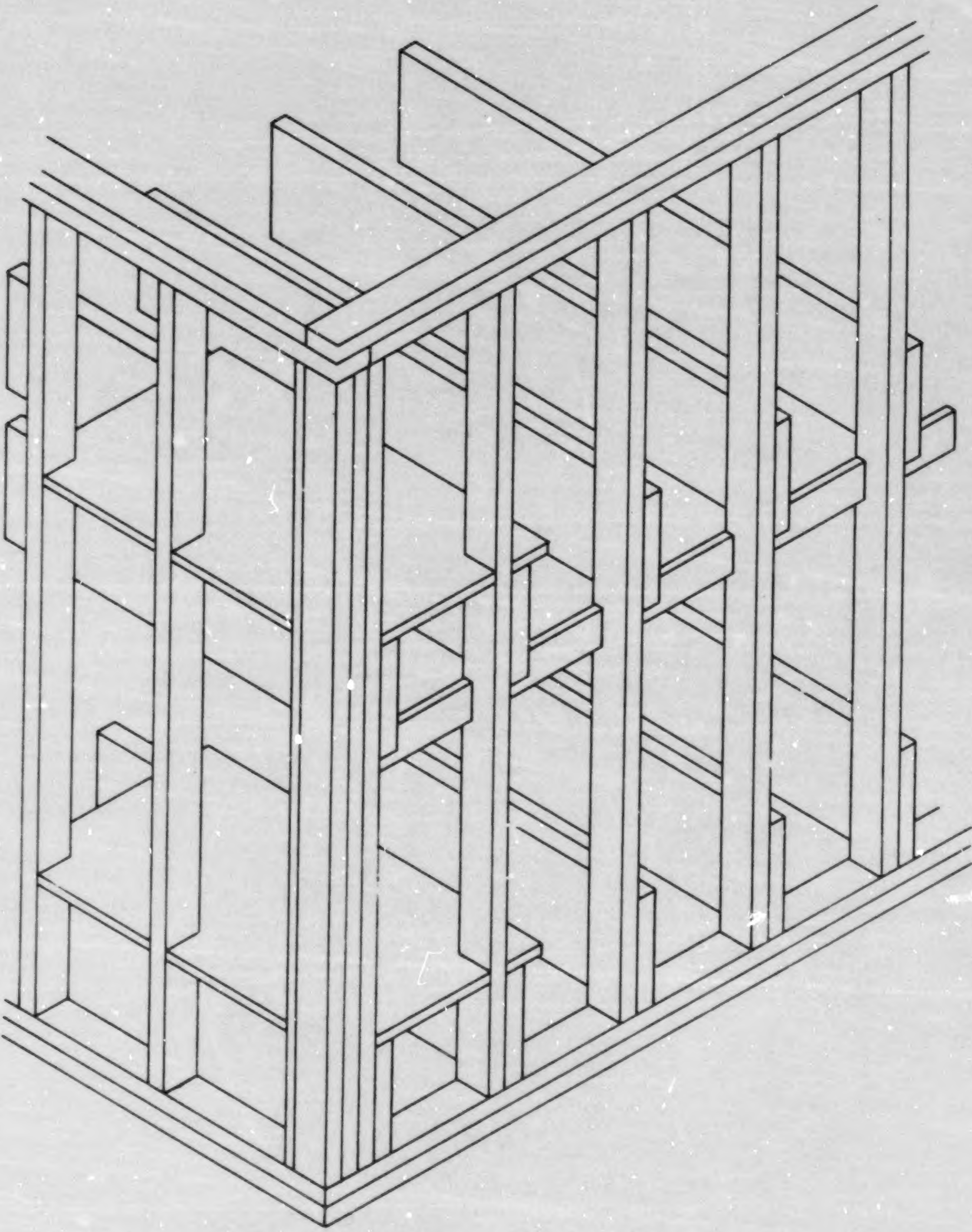


CLEARING THE SITE

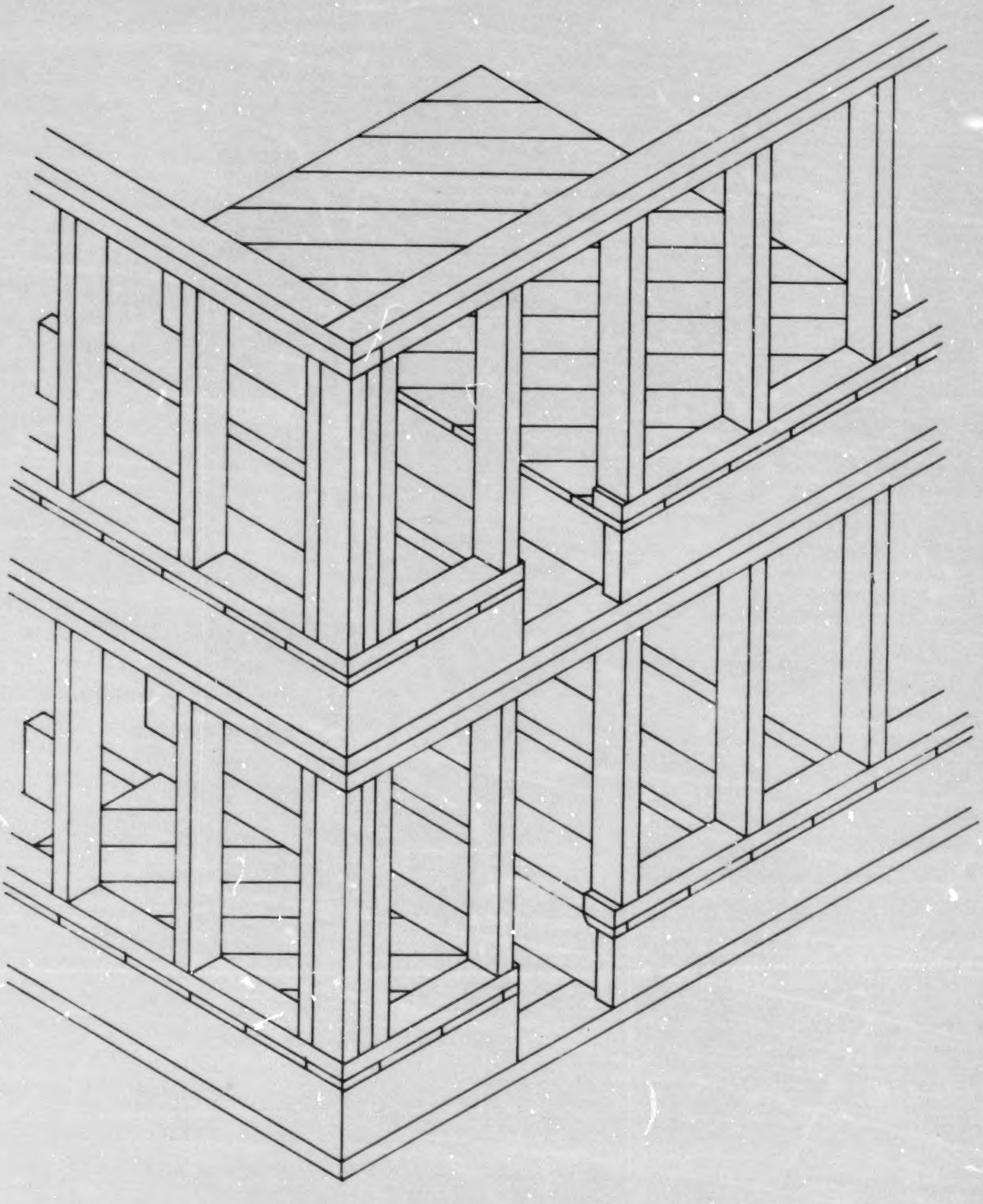




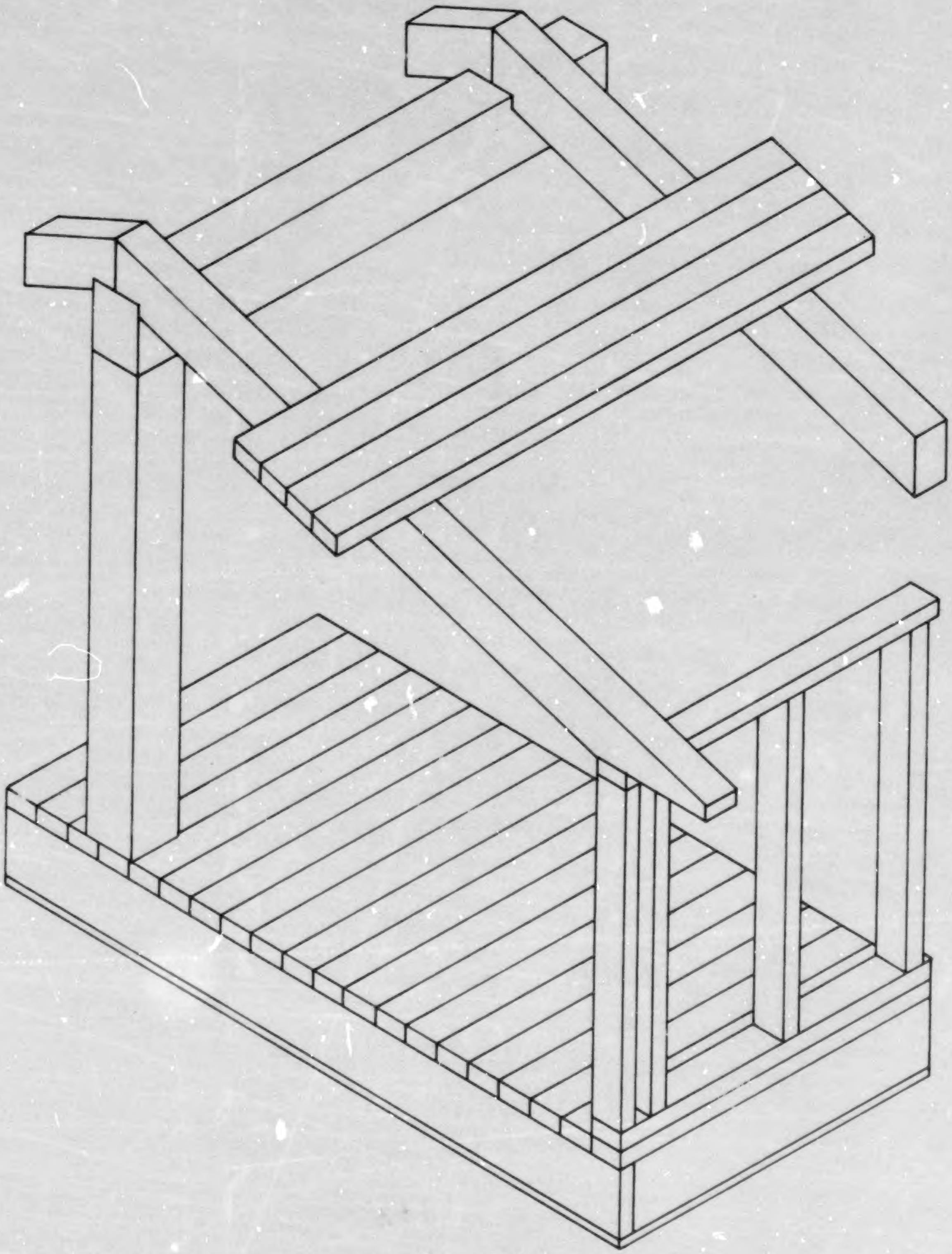
BALLOON FRAMING



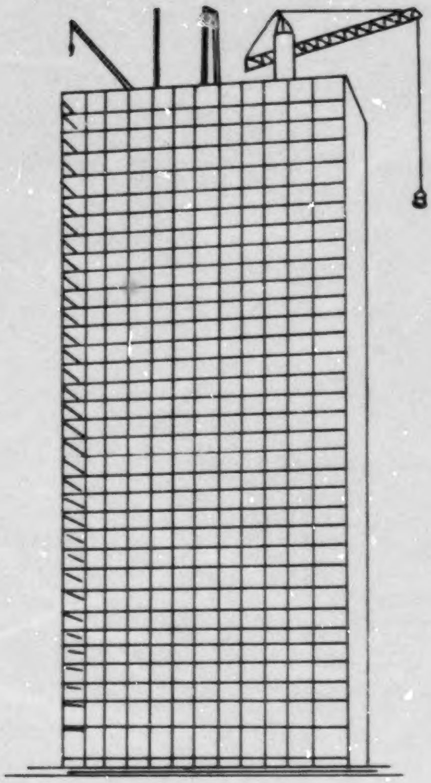
PLATFORM FRAMING



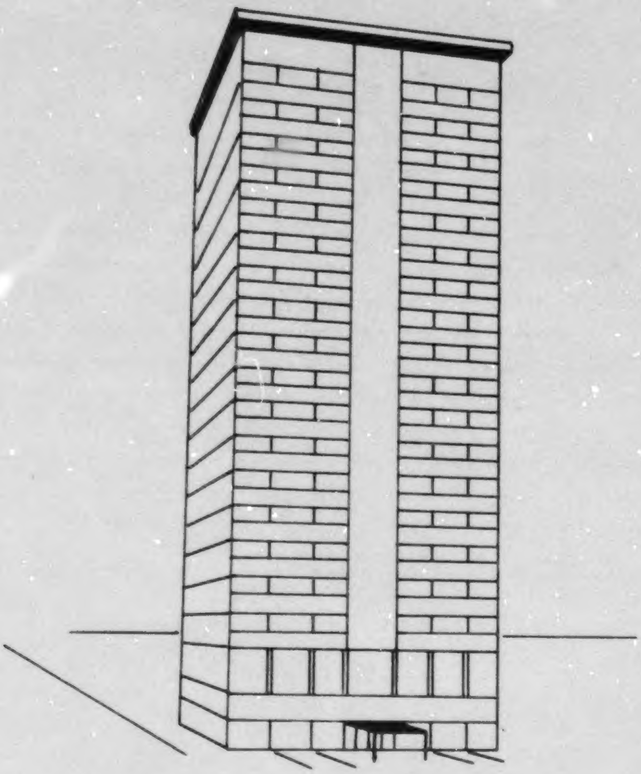
PLANK AND BEAM FRAMING



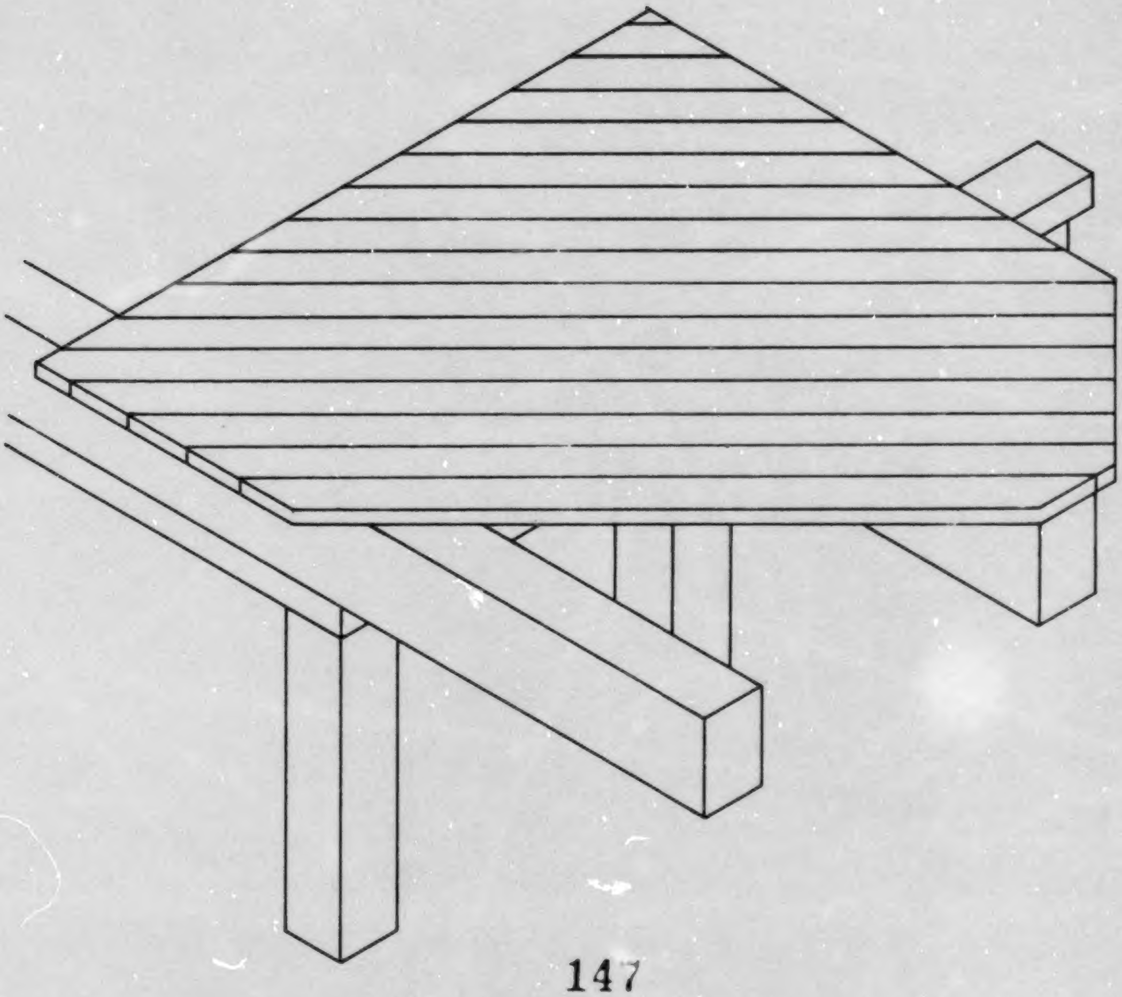
SKELETON FRAMING



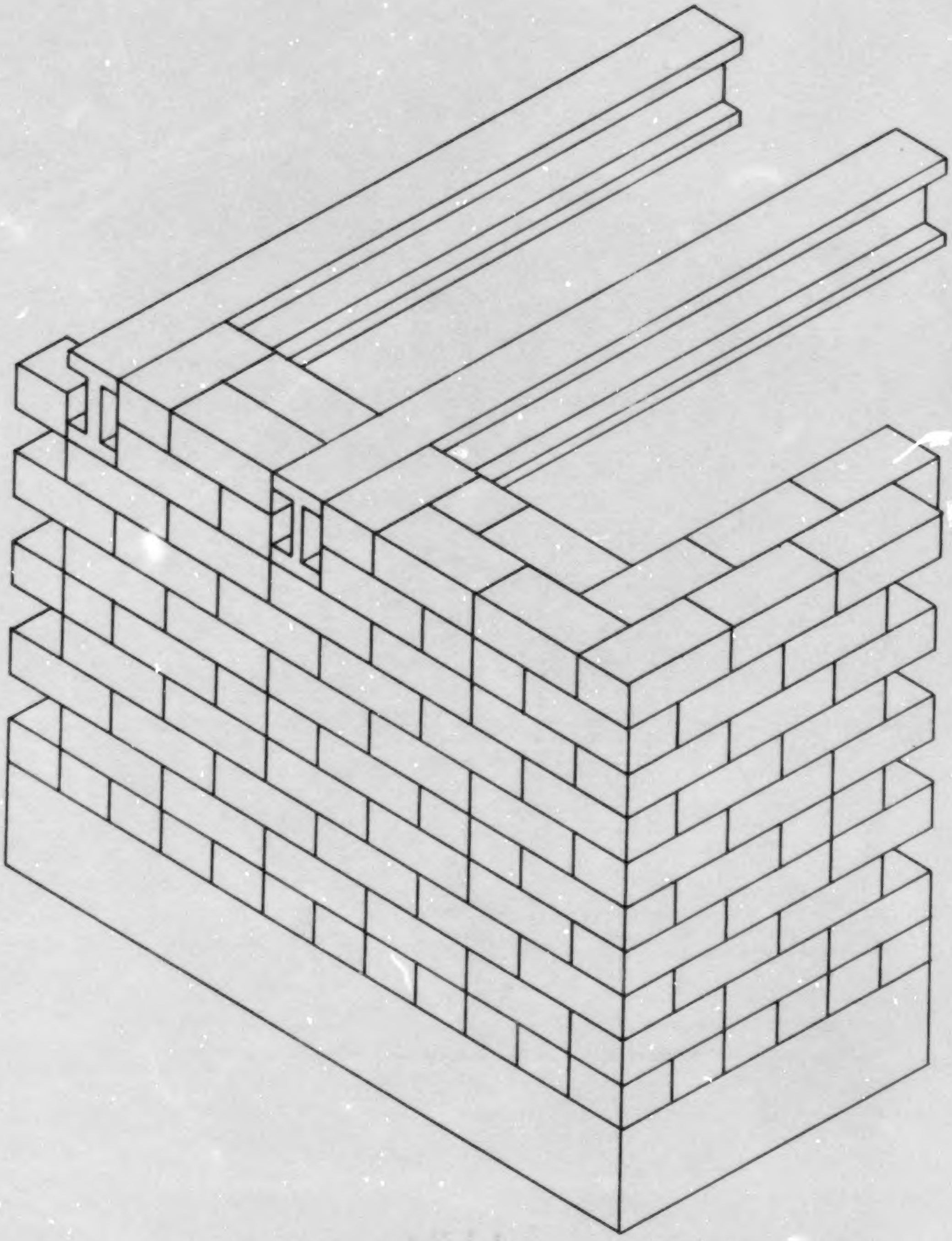
CURTAIN-WALL FRAMING



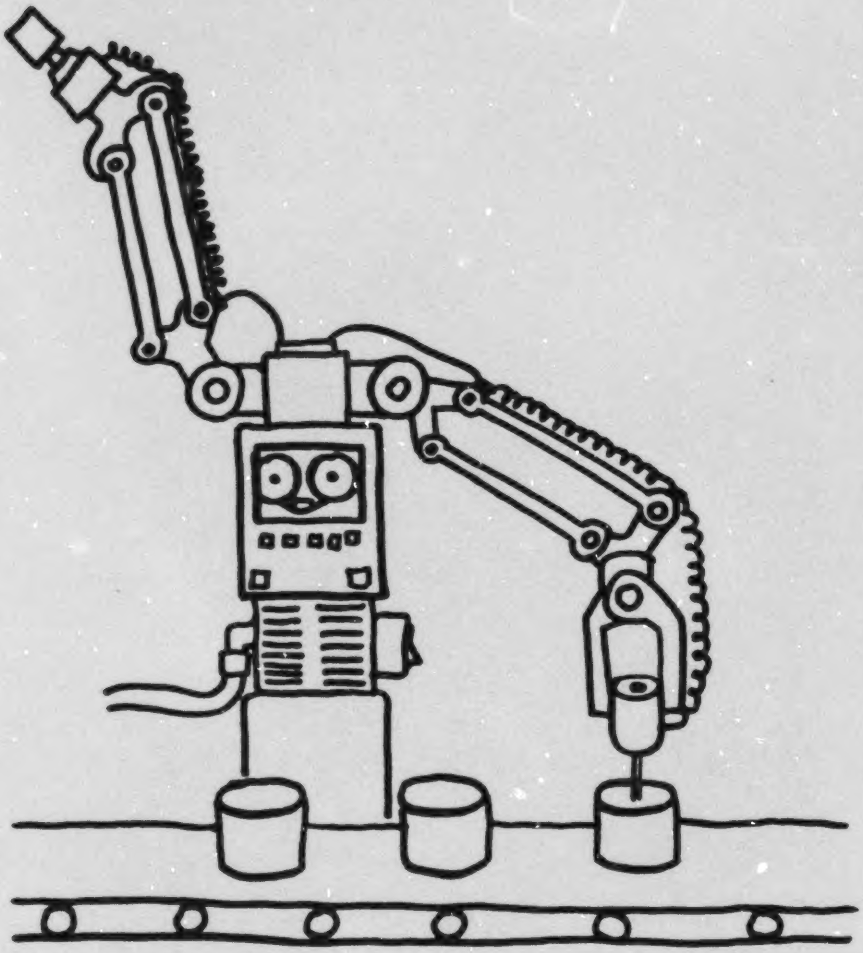
CANTILEVERED FRAMING



BEARING-WALL FRAMING



ENTREPRENEURSHIP



6

Entrepreneurship

OBJECTIVES

After students have covered the material in this unit, they should be able to—

1. describe the fundamental differences between the three major economic systems of communism, socialism, and capitalism;
2. list several ways that individuals and companies can invest capital to make more money;
3. describe the free enterprise system as it relates to the industrial system in the United States;
4. describe an entrepreneur;
5. describe the guidelines for entrepreneurship; and
6. list three controls that regulate the free enterprise system.

KEY WORDS: VOCABULARY

The words in the following list may be new to the student studying construction. Instructors should help students understand these words as they are used in this topic of study.

economy
communism
socialism
capitalism
capital
entrepreneurship
regulation
partnership
corporation
investment
profit
stocks
competition
free enterprise system
supply and demand
sole proprietorship
business plan
financial plan

TEACHING AID

Test Key: 1-C, 2-A, 3-B, 4-B, 5-D, 6-B, 7-A, 8-C, 9-C, 10-D

SUGGESTED REFERENCES

Fales, J.; Sheets, E.: Mervich, G.; and Dinan, J. Manufacturing: A Basic Text For Industrial Arts. Bloomington, Ill.: McKnight Publishing Company, 1980.

Wright, T. R., and Jensen, J. R. Manufacturing Materials Processing, Management, Careers. South Holland, Ill.: Goodheart-Willcox, 1976.

SENTENCE OUTLINE

I. Introduction
  A. Three types of ownership
    1. **Sole proprietorship** refers to a single person owning a business
    2. **Partnership** refers to several people owning a business together.
    3. A **corporation** exists when shares of stock are sold to individuals and these individuals act as one to operate the business.
  B. All companies are organized in a certain hierarchical structure, with various line and staff functions and responsibilities.

C. Entrepreneurship involves the functions of planning, organizing, controlling, and directing workers and activities.

D. It involves the feasibility of providing a product or service of high quality to the consumer at a fair price.

E. Securing and training manufacturing workers for the business is a vital part of entrepreneurship.

F. Scheduling workers and routing materials for the job is a major responsibility to the overall success of the business. Seeing that the job is completed on time with good workmanship is another.

II. What is communism? (examples: Russia and China)

A. This type of government is highly centralized with a small group of governmental leaders making major economic decisions for everyone.

B. The government owns the means to production (such as land, raw materials, factories, stores, and transportation).

C. Communism and socialism are basically the same, except politically. Communism may favor revolution and force to spread its beliefs, whereas socialism advocates peaceful political change.

D. Entrepreneurships cannot exist in a highly centralized form of government where risk taking is discouraged.

III. What is socialism? (examples: Sweden and Denmark)

A. Socialism is similar to communism in that the means of production are owned by the government and a small group of leaders determine what, when, and how much to produce.

B. Advocates of socialism believe in peacefully blending their belief into society.

C. Most socialist states are mixed, allowing the coexistence of capitalism.

D. Entrepreneurship can flourish in a mixed socialist and capitalist state, but cannot exist in a pure socialist country.

IV. What is capitalism? (examples: United States and Canada)

A. Capitalism is an economic system that stresses private economic decision making. It operates without the overall economic grand plan common to the communist and socialist economic systems.

B. Capitalism is based on capital, or the surplus money of a company or individual.

C. Capital is invested by individuals or companies with the hope of making more money.

1. An individual may invest capital in a bank that pays interest, or take more of a risk and invest it in stocks which provide capital to companies.

2. A company may invest its capital in new machines and facilities to produce more, better, or new products in hope of making a profit or more money from its capital.

V. The free enterprise system and entrepreneurs

A. The industrial system in the United States is known as a free enterprise system, and the individuals and companies are free to make nearly any product they wish.

B. The free enterprise system encourages individuals and companies to become entrepreneurs.

C. Entrepreneurs are risk takers who invest capital to product products with the hope of making a profit.

D. The free enterprise system is controlled by the law of supply and demand, competition, and regulation.

1. Supply and Demand. When demand is high for a product, entrepreneurs are willing to invest capital to produce more of a product, but a high supply of a product discourages entrepreneurs from investing capital.

2. Competition. This is also a characteristic of a free enterprise system. Competition allows for two or more companies to produce similar products and to compete in the marketplace for the consumer's dollar. The company

that produces the best product, at the lowest price, usually makes the most profit.

    3. Regulations. These are set by the government and private agencies to control the type and specifications of a certain product. (Example: The Environmental Protection Agency (EPA) requires car makers to control the pollutants they emit into the environment, or the Food and Drug Administration (FDA) requires that new medicines placed on the market are safe.)

VI. Becoming an entrepreneur
  A. An enterprise is any business that sells either products or services, or both, and is owned, managed, and controlled by one or more persons.
  B. All enterprises carry with them basic risks. There are no guarantees of success, of making a profit, or that you will avoid our economic system.
  C. Private enterprise in America is a privilege of our economic system.
  D. Our entire business system is made up mostly of small, privately owned companies.
  E. Our marketing system and competition within the markets for products and services is the strength of America.
  F. Our system is efficient because competition forces individual owners to streamline, cut waste, improve products and their services, and place the consumer or customer at the top of the economic pile.
  G. Entrepreneurship lets you decide your own destiny.
  H. The entrepreneur's keys to success are how well you manage what you have and how well you plan.
  I. Entrepreneurship provides challenge and personal satisfaction.
  J. Satisfaction is knowing that you provide a valuable service to customers and make their lives better.

VII. Dangers and pitfalls to avoid
  A. Owning and managing a business requires great personal sacrifice.
  B. Ownership requires serious responsibilities.

VIII. Guidelines for entrepreneurship
  A. Get the right kind of assistance.
    1. Seek literature, publications, periodicals, textbooks, and other resources that give advice and essential knowledge.
    2. Visit the Small Business Administration offices.
    3. Talk to a local banker.
    4. Practical experience can be gained by working in the kind of business you wish to operate.
  B. Prepare a plan.
    1. You need a business plan.
    2. You need a marketing plan.
    3. You need an operating (profit and loss) plan.
    4. You need an organization and staff plan.
    5. You need job descriptions and responsibilities assigned to functions.
  C. Get the financial assistance you need before you start.
    1. You need a good credit rating.
    2. You must know what you want to do.
    3. You must have a good plan.
    4. You must demonstrate good management and financial responsibilities.
    5. There should be a good balance between personal assets and borrowing funds.

D. Get professional marketing assistance.
    1. A competent commercial real estate agent can help you choose a good location, lease a building, buy an existing business, or perhaps develop a new business in a new location.
    2. You need an expert accountant to help you plan your finances, maintain your records, set up the right kinds of ledgers and accounts, interest rates, equipment purchases, employee records, tax reporting, and business planning.
    3. You need a competent attorney to help you plan the legal forms of ownership of your business, negotiate contracts and leases, get the right kinds of licenses and permits, and decide the types of liabilities you should assume.
    4. You need help of the local chamber of commerce or merchants' association.
    5. You need to join a professional trade association.

IX. Planning your business
  A. Financial planning
    The Bank of America suggests that an entrepreneur begin by asking four questions:
    1. What do I need the money for?
    2. How much money do I need?
    3. How and when can I repay the money borrowed?
    4. Can I afford to borrow money at this time?
  B. Business plan
    A good plan has seven parts.
    1. description
    2. market analysis
    3. product and service description
    4. sources of supply
    5. marketing plan
    6. management plan
    7. financial forms

MATERIALS FOR STUDENTS

- Vocabulary worksheet
- Newspaper, magazines
- Student handouts
- Notebook

SUGGESTED STUDENT ACTIVITIES

1. Select particular stocks from the newspaper and follow their activity for a month. Determine if a profit or loss has been made.
2. Research the three economic systems of communism, socialism, and capitalism.
3. Discuss the differences between communism, socialism, and capitalism.
4. Class officers will conduct a meeting to decide which product or service will be of economic value to the class or AIASA. The class will work as a group to form an enterprise. An enterprise committee will organize the technical and financial details for the class members. The entire class will work to make a profit for the class or to pay for AIASA dues or other activity (see Student Handouts No. 1-4).
5. Have students build a product of their choice. This product may fulfill a personal need, be for a family member, and be sold to someone in the community. Students should show a profit for their efforts. Compare this type of enterprise with that in Activity 4.
6. Have a real estate agent, an accountant, and a banker serve on a panel to discuss business and financial planning with the class. This should be done through an AIASA activity.

Vocabulary Worksheet

1. economy

2. communism

3. socialism

4. capitalism

5. capital

6. entrepreneurship

7. regulation

8. investment

9. profit

10. stocks

11. competition

12. free enterprise system

13. supply and demand

14. sole proprietorship

15. partnership

16. corporation

17. business plan

18. financial plan

TEST

Unit 6: Entrepreneurship

Directions: Read each statement carefully. Select the word or phrase that correctly answers or completes the statement, and write the appropriate letter in the blank.

Example: __D__ 21. The class that you are in is—
A. Science
B. English
C. Art
D. Industrial Arts

___ 1. What type of economy has an overall grade plan for what will be produced and who owns the means of production?
A. capitalism
B. socialism
C. communism
D. all the above

___ 2. What economic system, due to its lack of government control, strongly encourages entrepreneurship?
A. capitalism
B. socialism
C. communism
D. all the above

___ 3. Capital is—
A. money needed for basic survival needs of food, shelter, or clothing
B. surplus money an individual or company can use to invest
C. money put into a savings account
D. money invested in a company

___ 4. An entrepreneur—
A. can do well in a communistic country
B. is a risk taker
C. both of the above
D. does not need to make profits

___ 5. What controls determine what will be produced in a free enterprise system?
A. supply and demand
B. competition
C. government
D. all the above

___ 6. What is stock?
A. money put into a savings account
B. money invested in a company
C. money needed for basic survival needs of food, shelter, or clothing
D. surplus money an individual can use to invest

___ 7. Sole proprietorship—
A. is a single person owning a business
B. is several people owning a business together
C. exists when shares of stock are sold to individuals and these individuals act as one to operate the business
D. is none of the above

___ 8. Partnership—
A. is a single person owning a business
B. is several people owning a business together
C. exists when shares of stock are sold to individuals and these individuals act as one to operate the business
D. is none of the above

___ 9. A corporation—
A. is a single person owning a business
B. is several people owning a business together
C. exists when shares of stock are sold to individuals and these individuals act as one to operate the business
D. is none of the above

___ 10. A business plan—
A. only includes a market analysis
B. only includes a product and service description
C. only includes a management plan
D. none of the above

STUDENT HANDOUT NO. 1

PURCHASE ORDER

PURCHASER ______________________________

ADDRESS ______________________ PHONE NO. ________

CITY ______________ STATE ________ ZIPCODE ____

JEWERY BOX NO. _____ COST $4.25 EA. TOTAL _____

DATE OF PURCHASE ______________________

SELLER FROM WHOM PURCHASED ______________

DATE TO BE DELIVERED ______________________

THE JEWERY BOX WHICH YOU ARE PURCHASING IS A PRODUCT OF THE WHITTIER HAWKS MANUFACTURING TECHNOLOGY CLASS AT WHITTIER MIDDLE SCHOOL. THE CLASS IS IN KEEPING WITH THE NEW TECHNOLOGY COURSE THAT WILL BE TAUGHT NEXT YEAR IN TEXAS AN POSSIBLY ACROSS THE UNITED STATES.

THANK YOU FOR YOUR PURCHASE.

THE COST IS TO COVER EXPENSES OF MATERIAL, ONLY.

WHITTIER HAWKS
1984
MANUFACTURING COMPANY

STUDENT HANDOUT NO. 2

INTERVIEW RATING FORM

Scoring: Very Good = 15 Good = 10
Fair = 5 Poor = 0

ITEM	Score	Scale	
Grooming	15	181-195	
Clothes	15	VERYGOOD	☐
Posture	10	131-180	
Manners	15	GOOD	
Language	12		☑
Face and Body Contral	15	66-130	
Attitude	10		
Personality	10	FAIR	
Interview Skills	10		☐
Motivation	15	0-65	
Preparation	10		
Qualifications	15	POOR	
Potential	15		☐
Total	167		

Name: Susanna Garcia

Interviewer R Pyle

STUDENT HANDOUT NO. 3

WHITTIER HAWKS MFG. CO.
2101 Edison Drive
San Antonio, Texas 78201
512-735-7181

APPLICATION FOR NON-CERTIFIED PERSONNEL
AIDES, FOOD SERVICE AND MAINTENANCE APPLICANTS

PERSONAL DATA

POSITION DESIRED: ____________________ SALARY DESIRED: ____________

DATE AVAILABLE: ____________ AVAILABLE FOR: ☐ FULL TIME ☐ PART TIME ☐ TEMPORARY ☐ 12 mos. ☐ 10 mos.

1. NAME: ____________________ (Last, First, Middle, Other) ____________ (Social Security No.)

2. ADDRESS: ____________________ (Number & Street, City, State, Zip Code)

3. DATE OF BIRTH: ___/___/___ (Month, Day, Year) ☐ Citizen ☐ Non-Citizen

4. PHONE: Area Code ______ Home: ____________ Office: ____________ Other: ____________

EDUCATION AND TRAINING

Circle Highest Grade Completed: 7 or less 8 9 10 11 12	Did you Graduate? No ☐ Yes ☐ Year:	High School Equivalency Test (G.E.D.) Date Passed: State Awarded:

Type of School	School Name And Location	Type of Diploma or Degree Awarded	Major	Hrs.	Minor	Hrs.	Dates Attended	
							From	To
LAST HIGH SCHOOL ATTENDED								
COLLEGES ATTENDED								
OTHER (Military, Trade, Business, Secretarial, Etc.)								

SPECIAL QUALIFICATIONS (Include active technical/professional licenses, certificates, academic or professional awards, State/Date)

FOREIGN LANGUAGES YOU CAN
☐ Speak ☐ Read ☐ Write

SKILLS:
Typing (W.P.M.) ______ Shorthand (W.P.M.) ______ Other ________
Office machines you can operate:

PER A-2 (Rev. 1/80)

AN EQUAL OPPORTUNITY EMPLOYER
M/F HANDICAPPED

LAST NAME ________ FIRST ________ M.I. ________

STUDENT HANDOUT NO. 3

6. EMPLOYMENT HISTORY

In the space provided below, give your employment history. Begin with your present or most recent employer and list all positions held, including military, part-time, summer, volunteer work, and any periods of unemployment.

a. NAME OF EMPLOYER: ____ FROM: ___/___/___ (Month, Day, Year) TO: ___/___/___ (Month, Day, Year)
ADDRESS: ____
____ IMMEDIATE SUPERVISOR: ____
PHONE: ____ SALARY: ____ PER: ____
JOB TITLE: ____ REASON FOR LEAVING: ____
Briefly Describe the Work you Performed
____
____

b. NAME OF EMPLOYER: ____ FROM: ___/___/___ (Month, Day, Year) TO: ___/___/___ (Month, Day, Year)
ADDRESS: ____
____ IMMEDIATE SUPERVISOR: ____
PHONE: ____ SALARY: ____ PER: ____
JOB TITLE: ____ REASON FOR LEAVING: ____
Briefly Describe the Work you Performed
____
____

c. NAME OF EMPLOYER: ____ FROM: ___/___/___ (Month, Day, Year) TO: ___/___/___ (Month, Day, Year)
ADDRESS: ____
____ IMMEDIATE SUPERVISOR: ____
PHONE: ____ SALARY: ____ PER: ____
JOB TITLE: ____ REASON FOR LEAVING: ____
Briefly Describe the Work you Performed
____
____

d. NAME OF EMPLOYER: ____ FROM: ___/___/___ (Month, Day, Year) TO: ___/___/___ (Month, Day, Year)
ADDRESS: ____
____ IMMEDIATE SUPERVISOR: ____
PHONE: ____ SALARY: ____ PER: ____
JOB TITLE: ____ REASON FOR LEAVING: ____
Briefly Describe the Work you Performed
____
____

e. NAME OF EMPLOYER: ____ FROM: ___/___/___ (Month, Day, Year) TO: ___/___/___ (Month, Day, Year)
ADDRESS: ____
____ IMMEDIATE SUPERVISOR: ____
PHONE: ____ SALARY: ____ PER: ____
JOB TITLE: ____ REASON FOR LEAVING: ____
Briefly Describe the Work you Performed
____
____

(If additional space is needed, enter information under Item 13, page 4.

STUDENT HANDOUT NO. 3

7.

REFERENCES

LIST THREE PERSONS WHO ARE NOT RELATED TO YOU BY BLOOD OR MARRIAGE WHO HAVE NOT ALREADY BEEN LISTED IN ITEM NO. 6 WHO CAN COMMENT ON YOUR EDUCATION AND/OR WORK EXPERIENCE.

FULL NAME	OCCUPATION	PHONE: OFFICE HOME	ADDRESS	
			STREET	CITY AND STATE
		O: H:		
		O: H:		
		O: H:		

8. CRIMINAL RECORD: Have you ever been convicted of a felony or a crime involving moral turpitude? Moral turpitude includes such crimes as fraud, swindling, and sex-related offenses. You may omit juvenile offenses or convictions that have been set aside after successful completion of a probation period. ☐ Yes ☐ No (If the answer is yes, please give details relating to the date of conviction, place of conviction, the court in which convicted, the case number and the sentence under Item No. 13 - page 4.

9. CONDITION OF HEALTH: Have you had a serious mental or physical illness, major surgery, or sustained an injury which could impede the successful performance of your duties _____ ? Do you have a chronic health condition which could affect the successful performance of your duties _____ ? (If answer is YES to any of the above questions, please explain under Item 13 - page 4.)

10. HAVE YOU EVER BEEN AN EMPLOYEE OF THE WHITTIER HAWKS MANUFACTURING COMPANY ?

If so: Position Title _______________ Employment Dates _______________

School or Organization _______________

11. Are you related in any way including by marriage to any board member presently serving on the Board of Trustees? ☐ Yes ☐ No (If so, please indicate person and relationship:

_______________ _______________)

GENERAL INFORMATION

Please be sure you have signed and dated this application on page 4 and answered every question clearly and completely.

Each applicant appointed a position in the district must meet all requirements of the position, including the successful completion of any applicable aptitude test (if required), medical examination and a confidential investigation, and each appointee must submit all requested documents.

....

12. The following information is requested for Personnel Office Use Only in order to assist us in complying with E.E.O. reporting guidelines:

1. ETHNIC GROUP: American Indian _____ Black _____ Asian American _____ Hispanic _____ Other _____
2. SEX: Male _____ Female _____

....

AN EQUAL OPPORTUNITY EMPLOYER
M/F HANDICAPPED

STUDENT HANDOUT NO. 3

13.

page 4

SPACE FOR DETAILED ANSWERS TO OTHER QUESTIONS

ITEM NUMBER	WRITE IN LEFT COLUMN NUMBER TO WHICH ANSWERS APPLY.

I, the undersigned, affirm that the information included in this application is true and complete. I understand that failure to include true and complete information may result in my disqualification for consideration for employment and/or dismissal from my position in this school district. I also understand that the references and personal information which become a part of this application are regarded as confidential and shall not be revealed to me.

Signature of Applicant ______________________

Date Signed ______________________

WE THANK YOU FOR MAKING APPLICATION FOR EMPLOYMENT WITH

WHITTIER HAWKS MFG. CO.

FOR OFFICE USE ONLY

Date Received ______	Applicant Hired in Position of: ______
To Keypunch ______ From Keypunch ______	Title: ______ Job Code: ______
Application Screened by ______ Date ______	Organization: ______
Interviewed by ______ Date ______	Beginning Date: ______
Processing Clerks Initial ______	Pay Grade ______ Step ______
REMARKS:	PERSON TO BE CONTACTED IN CASE OF EMERGENCY ______ NAME ______ ADDRESS PHONE

STUDENT HANDOUT NO. 4

WHITTIER HAWKS MANUFACTURING COMPANY

POSITION	SHIFT 1	SHIFT 2	SHIFT 3	SHIFT 4
GENERAL FOREMAN	DAVID ABREGO	JOSE SERNA	ROBERT HERNANDEZ	MIKE ALEXANDER
LINE FOREMAN	KENNETH FLORES	PEDRO CASTRO	RICHARD GARZA	JESSE GARZA
SETUP FOREMAN	ALBERT JIMENEZ	JOHN GONZALES	DANIEL TORRES	JOSE GARZA (BIG)
SAFETY FOREMAN INSPECTOR	SUSANNA GARZA	JOE VILLARREAL	MICHELLE [illegible]	RAYMOND OCHOA
TOOL CRIB FOREMAN	JOHN FERNANDEZ	THOMAS NEUBAUER	THOMAS FERNANDEZ	MARK FRAUSTO
LINE INSPECTORS	RUBEN RODRIGUEZ	DANIEL GARZA	[illegible] MEZQUITA	PAT RAMOS
CLEAN UP FOREMAN	ANDREW GARCIA	ARTURO CORTEZ	SAL ZAMORA	JOSE GARZA (LITTLE)
MACHINE OPERATOR				
DRILLS 1	JESSE PEREZ	JOHN RODRIGUEZ	JUAN ALVARADO	LARRY BOWDEN
2	EDUARDO SANCHEZ	DIRK MARTELL	JUNO ALVARADO	ADRIAN ESQUEDA
3	LUPE NAVAIRA	JOHN LOPEZ	RAYMOND FLORES	DAVID MARTINEZ
PLANER 1	RONALD BROWCE	RICKY RICARTE	RICHARD GARZA	ALEXANDER MESQUITI
2	ALEX CORTEZ	JOSE LOPEZ	ROBERT GARZA	DANIEL SAUCEDA
~~SAW~~ 3	DANNY CARLSON	PEDRO CASTRO	ANGEL MARTINEZ	JAMES SHUCK
SAW 1	DAVID ABREGO	JOSE SERNA	ROBERT HERNANDEZ	BIG JOSE GARZA
2	ALBERT JIMENEZ	ARTURO CORTEZ	ROBERTO MENDOZA	MICHAEL ALEXANDER
SANDER 1	KEN FLORES	JOHN GONZALES	DAVID SILVA	ERNEST QUINTERO
2	GERARDO ALONZO	ROY LAGUE	JEFFERY SILVA	RUBEN [illegible]
ASSEMBLER 1	HECTOR RUIZ	PAT ARELLANO	ALAN ZAMARRIPA	MARK FRAUSTO
2	EDWARD GARZA	GERARDO CASTILLO	SERGIO [illegible]	PAT RAMOS
3	RICHARD GONZALES	DANIEL GARZA	RICHARD VALADEZ	NANCY MONTANO
4	JOHN FERNANDEZ	CARLOS GONGORA	MICHELLE SALINAS	AUGUSTINE HERNANDEZ
5	ANDREW GARCIA	SERGIO GONZALES	VERNON REYES	REYNALDO CASTELLANO
6	SUSANNA GARCIA	JOSE HERNANDEZ	ALFONSO MUNOZ	JOSE GARZA
FINISHER 1	RALPH MARTINEZ	JOE VILLARREAL	HENRY GARZA	LITTLE JOSE GARZA
2	[illegible] MEDINA	THOMAS NEUBAUER	THOMAS FERNANDEZ	RAYMOND OCHOA
3	RUBEN RODRIGUEZ	DIRK MARTELL	LOUIS MEZQUITA	JOSE SALAZAR
SALES PERSON			DANIEL TORRES	FRANCISCO SAUCEDA
1			SAL ZAMORA	
2				

BEST COPY AVAILABLE

7

Postconstruction

OBJECTIVES

After the students have covered the material in this unit, they should be able to—

1. analyze basic maintenance and repair problems in construction;
2. troubleshoot basic interior maintenance and repair problems;
3. troubleshoot basic exterior maintenance and repair problems;
4. troubleshoot basic electrical maintenance and repair problems;
5. troubleshoot basic plumbing maintenance and repair problems; and
6. demonstrate basic principles and procedures of altering or remolding a structure.

KEY WORDS: VOCABULARY

The words in the following list may be new to the students studying construction. Teachers should help students understand these words as they are used in this topic of study.

analyzing
troubleshooting
repairing
maintaining
altering
remolding
installing
plaster
sealing
finishing
fuse
receptacle
outlet
faucet

TEACHING AIDS

- Overhead projector
- Appendices A and B
- Test Key: 1-D, 2-A, 3-D, 4-B, 5-C, 6-A
- Transparencies: You will find transparencies C7-1 through C7-5 at the end of this unit. If you wish, these masters may be duplicated in quantity and given as handouts to the students while they are studying the different aspects of this unit.

  C7-1: Analyzing Basic Maintenance and Repair Problems in Construction
  C7-2: Troubleshooting Interior Maintenance and Repair Problems
  C7-3: Troubleshooting Exterior Maintenance and Repair Problems
  C7-4: Troubleshooting Electrical Maintenance and Repair Problems
  C7-5: Troubleshooting Plumbing Maintenance and Repair Problems

SUGGESTED REFERENCES

Betts, M. Roger; Hausenstein, A. Dean; and Fannin, John. Exploring the Construction Industry. Bloomington, Ill.: McKnight Publishing Company, 1976.

Cockrum, J. L. Painter and Paperhanger. Austin, Tex.: Extension Instruction and Materials Center, The University of Texas, 1977.

Lux, Donald G.; Ray, Willis E.; Blankenbaker, E. Keith; and Umstattd, William. World of Construction. Bloomington, Ill.: McKnight Publishing Company, 1982.

Notgrass, Troy. Plumber. Austin, Tex.: Extension Instruction and Materials Center, The University of Texas, 1982.

Sutton, Mark C. Building Maintenance Repairer. Austin, Tex.: Extension Instruction and Materials Center, The University of Texas, 1974.
Sutton, Mark C. Residential Electrician. Austin, Tex.: Extension Instruction and Materials Center, The University of Texas, 1977.

SENTENCE OUTLINE

I. Analyzing basic maintenance and repair problems (Transparency C7-1)
  A. Proper and routine maintenance and repair of structures and their equipment is crucial to their operations and longevity. It will save hundreds of dollars over the life of the structure.
  B. About one-third of the total money spent on construction is spent for servicing existing structures.
  C. Building maintenance and repair can be subdivided into—
    1. maintaining—taking care of structures;
    2. repairing—fixing the structure;
    3. altering—changing the structure; and
    4. installing—placing new equipment in the structure.
  D. A proper analysis of maintenance and repair problems will ensure the proper solution at the best price, with the least amount of inconvenience.
  E. Troubleshooting is analyzing maintenance and repair problems, then fixing them in the most cost-effective way.
  F. The following criteria should be observed, through good problems-solving techniques:
    1. What is the real source of the problem?
    2. Should it be repaired or replaced?
    3. What are the cost factors?
    4. Is professional help needed?
    5. What materials and tools are needed?
    6. What is the correct and best procedure for repairing or installing?

II. Interior maintenance and repair (Transparency C7-2)
  A. Interior maintenance and repair includes patching plaster and drywall, installing and repairing ceiling tile, installing and repairing floor covering, hanging wall coverings, and applying finishes to interior surfaces.
  B. Plaster. The following problems occur with plaster:
    1. problems due to weather
    2. problems due to sand quality and proportioning
    3. problems due to poor finishes
  C. Drywall. Repairing drywall requires knowing how to patch holes and dents in the drywall surface.
  D. Ceiling tile. Drop ceiling or tongue-and-groove ceiling materials can be used to repair or install new ceilings.
  E. Floor covering. Repairing or installing floor covering requires knowing how to lay and patch vinyl tile, quarry tile, carpet, and other coverings.
  F. Wall coverings. Repairing and installing wall covering requires knowing how to install and patch wallpaper, vinyl and textured materials, soundproofing materials, and other types of wall coverings.
  G. Finishing interior surfaces. Finishing interior surfaces includes knowing how to apply various paints, varnishes, and other interior finishing materials.

III. Exterior maintenance and repair (Transparency C7-3)
  Landscaping requires knowing how to—
  A. install wind breaks;
  B. install shade screens;

C. add patios, decks, fences, walls, and so on; and
D. plant trees, shrubs, and flowers.

IV. Electrical maintenance and repair (Transparency C7-4)
Electrical maintenance and repair includes knowing how to—
A. maintain motors and equipment;
B. replace fuses and breakers;
C. repair electrical cords; and
D. repair and install receptacles and outlets.

V. Plumbing maintenance and repair (Transparency C7-5)
Plumbing maintenance and repair includes knowing how to—
A. repair and replace faucets;
B. repair water pipes;
C. thaw water pipes; and
D. repair and replace water closet parts.

VI. Altering or remolding
Altering or remolding includes knowing how to—
A. redesign interiors and exteriors of structures;
B. add a room or addition; and
C. install alternative energy devices and energy conservation materials.

MATERIALS FOR STUDENTS

- Vocabulary worksheet
- Student activities

SUGGESTED STUDENT ACTIVITIES

1. Have students construct a wall section. Then have them go through the procedures and processes to a finished plastered wall.
2. For a school or community service project, have students repair or install a ceiling unit in the school or a community building.
3. Have students paint an area of the industrial arts facility, school, or a community area.
4. Have students perform various plumbing exercises: installing a faucet, repairing water pipes, and replacing water closet parts.
5. Have students landscape an area of the school or community.
6. Have students perform various electrical maintenance and repair problems: oiling and lubricating motors of the industrial arts equipment, replacing fuses and breakers, repairing electrical cords, and installing receptacles and outlets.
7. Have contractor or city planner talk to class on remolding and renovation. If the speaker cannot visit the class, have a group of students videotape the presentation to show to the class.

Vocabulary Worksheet

1. analyzing
2. troubleshooting
3. repairing
4. maintaining
5. altering
6. remolding
7. installing
8. plaster
9. sealing
10. finishing
11. fuse
12. receptacle
13. outlet
14. faucet

TEST

Unit 7: Conservation

Directions: Read each statement carefully. Select the word or phrase that correctly answers or completes the statement, and write the appropriate letter in the blank.

Example: __B__ 21. The class that you are in is—
A. Health
B. Industrial Arts
C. Science
D. Math

___ 1. Of the following, postconstruction includes—
A. troubleshooting interior problems
B. troubleshooting electrical problems
C. troubleshooting plumbing problems
D. all of the above

___ 2. Taking care of a structure is—
A. maintaining
B. repairing
C. altering
D. installing

___ 3. Placing new equipment in a structure is—
A. maintaining
B. repairing
C. altering
D. installing

___ 4. Fixing the structure is—
A. maintaining
B. repairing
C. altering
D. installing

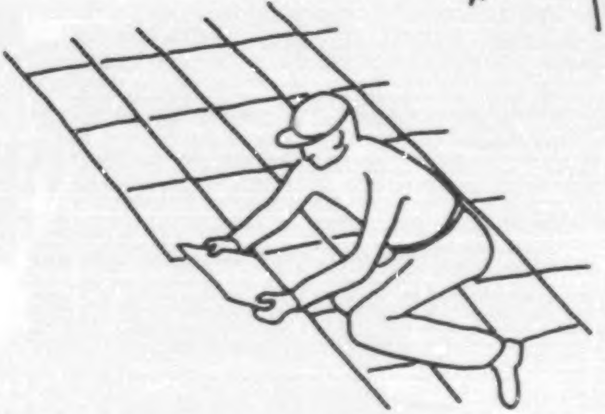
___ 5. Changing the structure is—
A. maintaining
B. repairing
C. altering
D. installing

___ 6. Analyzing maintenance and repair problems, then fixing them the most cost-effective way is—
A. troubleshooting
B. installation
C. alteration
D. replacement

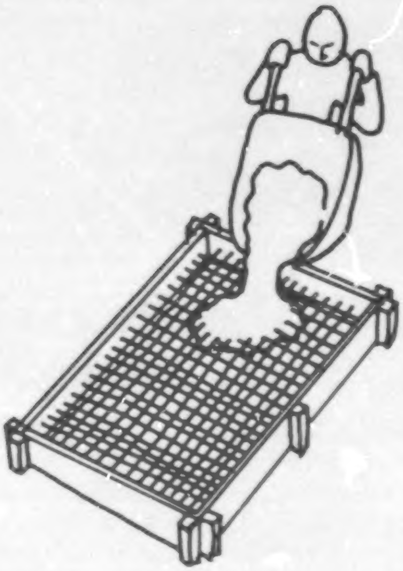
ANALYZING BASIC MAINTENANCE AND REPAIR PROBLEMS IN CONSTRUCTION

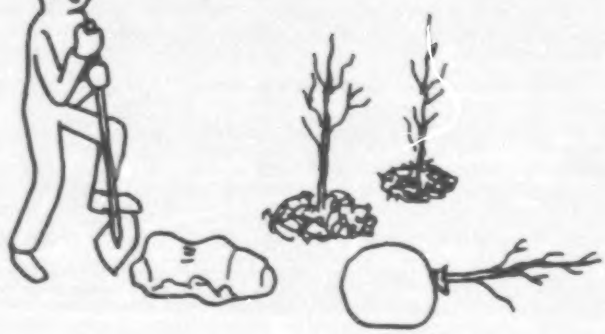
1. PROPER ROUTINE MAINTENANCE AND REPAIR OF STRUCTURES AND THEIR EQUIPMENT IS CRUCIAL TO ITS OPERATION, LONGEVITY, AND COST-EFFECTIVENESS OVER THE LIFE OF THE BUILDING.
2. SUBDIVISIONS OF MAINTENANCE AND REPAIR
   MAINTAINING
   REPAIRING
   ALTERING
   INSTALLING
3. MAINTENANCE AND REPAIR CRITERIA
   WHAT IS THE REAL SOURCE OF THE PROBLEM?
   SHOULD IT BE REPAIRED OR REPLACED?
   WHAT ARE THE COST FACTORS?
   IS PROFESSIONAL HELP NEEDED?
   WHAT MATERIALS AND TOOLS ARE NEEDED?
   WHAT IS THE CORRECT AND BEST PROCEDURE FOR REPAIRING OR REPLACING OR INSTALLING?

TROUBLESHOOTING INTERIOR MAINTENANCE AND REPAIR PROBLEMS

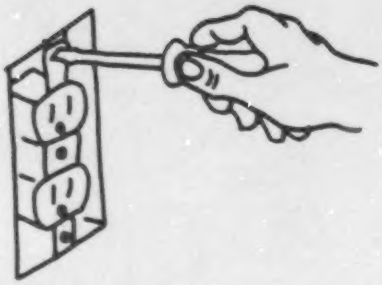


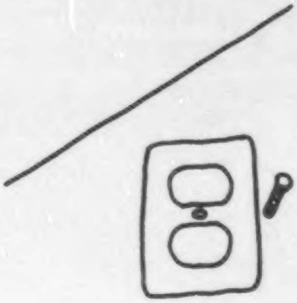
TROUBLESHOOTING EXTERIOR MAINTENANCE AND REPAIR PROBLEMS

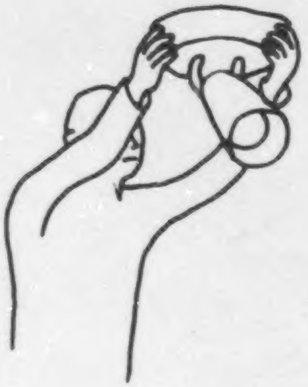


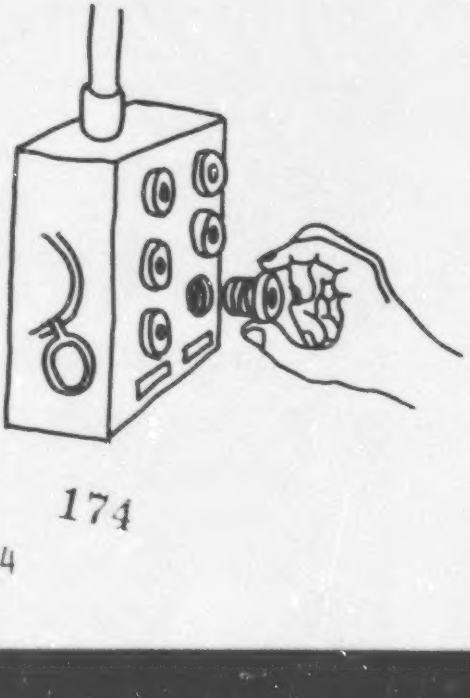


TROUBLESHOOTING ELECTRICAL MAINTENANCE AND REPAIR PROBLEMS

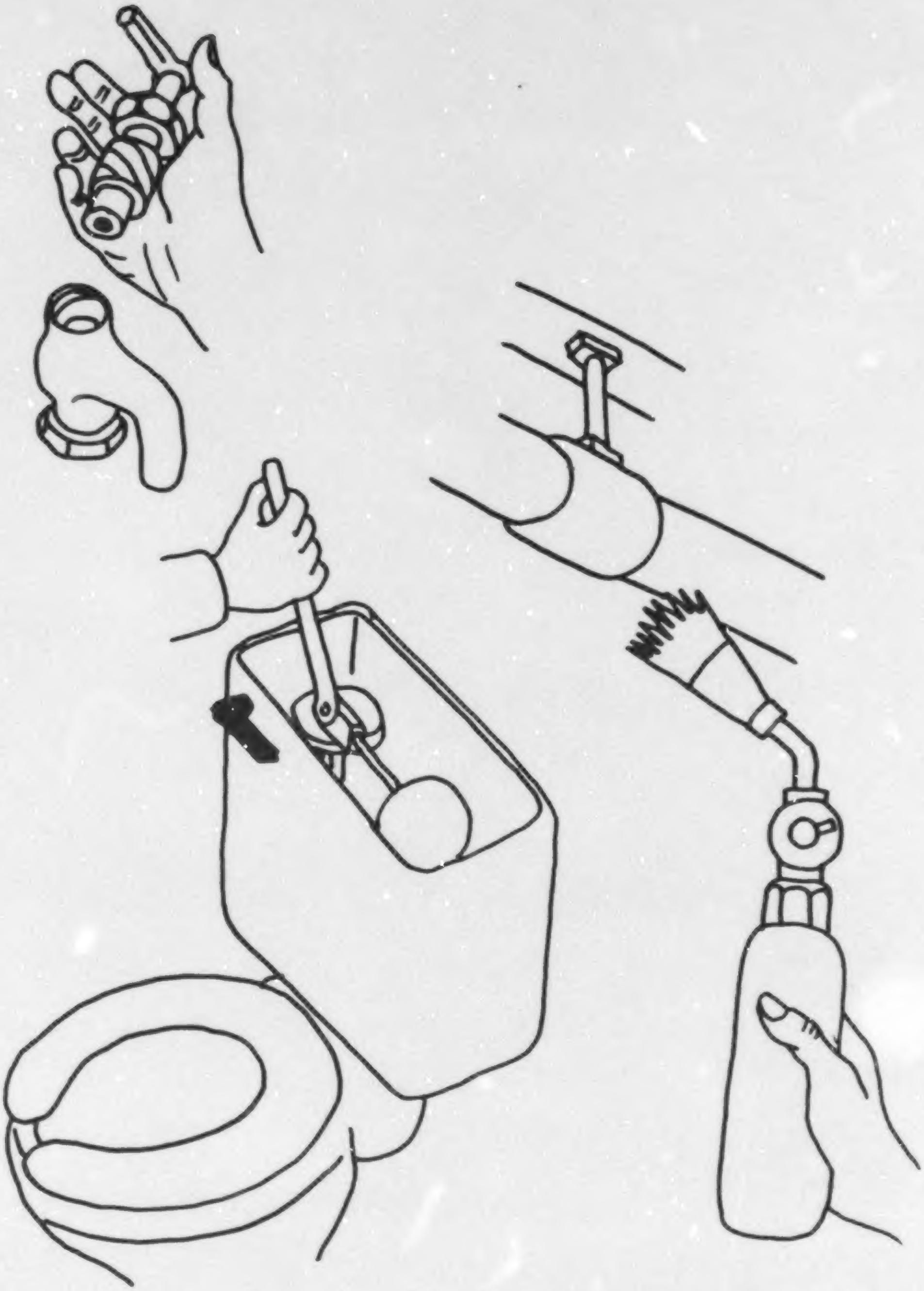








TROUBLESHOOTING PLUMBING MAINTENANCE AND REPAIR PROBLEMS



8

Computer Applications in Construction

OBJECTIVES

After students have covered the material in this unit, they should be able to—

1. explain the relationship of computers to construction;
2. give examples of how computers are used in construction management;
3. give examples of how computer-aided design (CAD) is used in construction; and
4. give examples of how robotics is used in construction.

KEY WORDS: VOCABULARY

The words in the following list may be new to the students studying construction. Teachers should help students understand these words as they are used in this topic of study.

special-purpose computers
general-purpose computers
computer programs
microcomputers
robotics

TEACHING AIDS

- Overhead projector
- Computer programs
- Appendices A and B
- Test Key: 1-B, 2-A, 3-C, 4-D
- Transparencies: You will find transparencies C8-1 through C8-3 at the end of this unit. If you wish, these masters may be duplicated in quantity and given as handouts to the students while they are studying the different aspects of this unit.

C8-1: Construction Management Applications
C8-2: Computer-aided Design
C8-3: Robotics in Construction

SUGGESTED REFERENCES

Arbib, Michael A. Computers and the Cybernetic Society. New York: Academic Press, 1977.

Bame, E. A., and Cummings, P. Exploring Technology. Worchester, Mass.: Davis Publications, 1980.

Covvey, H. Dominic, and McAlister, Neil H. Computer Consciousness: Surviving the Automated Eighties. Reading, Mass.: Addison-Wesley Publishing Company, 1980.

Goetsch, David L. The CAD/CAM Workbook. Cincinnati: South-Western Publishing Company, 1983.

Heiner, Carl W., and Hendrix, Wayne. People Create Technology. Worchester, Mass.: Davis Pulications, 1980.

Sanders, Donald H. Computers in Society. New York: McGraw-Hill Book Company, 1977.

Weiss, Eric. Computer Usage-Applications. New York: McGraw-Hill Book Company, 1970.

Willis, Jerry, and Miller, Merl. Computers for Everybody. Beaverton, Ore.: Dilithium Press, 1981.

SENTENCE OUTLINE

Note to the teacher: The following information on computers may be presented as a unit by itself. Or you may want to incorporate it in the previous units.

I. Introduction

New applications for computers are constantly being developed. Computers are used in almost every aspect of our lives. They are very important in the field of construction.

Types of computers. Before we discuss the specifics of computers in construction, let's discuss two broad types of computers.

- A. Special-purpose computers are very limited. They make up only a fraction of all the computers and are designed for just one application. They are wired internally to go through the identical sequence of operations every time. Such special-purpose computers cannot be made to do something new by changing the instruction under which they operate. You can make them do something new only by taking a soldering iron and changing the wiring. The instructions given are called computer programs. So these special-purpose computers are said to be not programmable, or nonprogrammable.
- B. General-purpose computers can be made to do any of a variety of jobs simply by changing the instructions given to them. The wiring remains the same. Only the programs are the same. Such computers need programming, but they are extremely flexible since a mere change in the program changes what they do.
- C. Another term that you should be familiar with in discussing the computer is the microcomputer. The microcomputer is the size of a desk or smaller. Microcomputers now exist that are as small as a head of a pin.

II. Construction management applications (Transparency C8-1)

- A. Computers can help one plan, organize, and control.
- B. Computers will provide more efficiency in the company's overall operations because of the ability to store and retrieve information at a high rate of speed.
- C. Personnel data can be stored in the computer for all employees (past and present) as well as for projected employment trends.
- D. Construction and economic trends can be stored in the computer so that the company can plan better for the future.
- E. Material and supply data can be stored in the computer. This includes:
  1. inventory control
  2. cost estimation
  3. scheduling and routing of materials
  4. equipment data, repair and maintenance
- F. The scheduling or workers for different jobs can be done on the computer.
- G. Financial data can be stored in the computer as well as a graphic representation.
- H. Safety management data can be stored in the computer.

III. Computer-aided Design (CAD) (Transparency C8-2)

- A. CAD is using computers to collect data, analyze it into a design, and to produce a final product with increased control and speed.
- B. CAD involves using the plotter, digitizer, absolute systems, incremental systems, and subroutine systems to design and draw structures.
- C. Basic operations
  1. Input is the collecting of relevant data to create designs and make working drawings.
  2. Storage involves data being processed and held for future use.

3. Manipulation involves the changing, editing, and correcting of designs and drawings.
4. Output is producing the final working drawings in a finished product.

D. Uses of CAD in construction
1. CAD systems are used to design and draw residential, commercial, and civil construction projects.
2. CAD systems are used to design and draw alternative energy systems for structures.
3. CAD systems are used to design and draw home improvement projects.
4. CAD systems are used to design and draw cabinet and millwork drawings.

IV. Robotics (Transparency C8-3)

A. Webster defines a robot as an automatic apparatus or device that performs functions ordinarily ascribed to human beings or operates with what appears to be almost human intelligence.

B. The three laws of robotics
1. A robot must not harm a human being, nor through inaction, allow one to come to harm.
2. A robot must always obey human beings, unless that is in conflict with the first law.
3. A robot must protect itself from harm, unless that is in conflict with the first two laws.

C. Robot characteristics
1. a hand, capable of gripping and releasing the workpiece
2. an arm that can move the hand in three planes
3. a wrist for the arm, with articulation to allow the hand/wrist assembly to be aimed anywhere in the workpiece.
4. sufficient muscle power to accomplish the job
5. positioning accuracy repeatability to 0.3 mm
6. manual controls, with which a person can operate all robot limb functions
7. a built-in memory that can learn the human teacher's instructions
8. automatic systems that allow the memory to control operations in the absence of the human teacher
9. a speed of operation that is as fast as a person's
10. a library of programs that can be selected at will, allowing the robot to be switched back to operations that it has been taught in the past
11. facilities for safety and process interlocks with the plant or machinery that is to be operated
12. a computer-compatible interface.
13. reliability of at least 400 hours MTBF (mean time between failure) in the actual working environment
14. configuration that allows easy maintenance, with quick access and interchangeability of parts in the event of breakdown, aided by self diagnostic routines

D. Robot qualities already commercially available
1. work space command with six infinitely controllable articulations between the robot base and its hand extremity
2. teach and playback facilities—realizing fast, instinctive programming
3. local and library memories of any size desired
4. random program selection possible by external stimuli
5. positioning accuracy repeatability to within 0.3 mm
6. weight-handling capability up to 150 kilos
7. point-to point control and continuous path control, possibly intermixed in one robot
8. synchronization with moving workpiece

9. interface allowing compatibility with computer
10. palletizing and depalletizing capability
11. high-reliability - with no less than 400 hours MTBF
12. all these capabilities, available for a price that allows purchase and operation within the traditionally accepted rules for economic justification of any new equipment.

E. Robot qualities sought for the future
   1. Rudimentary sense of vision to provide—
      a. recognition data
      b. orientation data
   2. Tactile sensing that gives—
      a. recognition data
      b. orientation data
   3. computer interpretation of the visual and tactile data
   4. multiple-appendage, hand-to-hand coordination
   5. computer-directed appendage trajectories
   6. mobility
   7. minimizing spatial intrusion
   8. energy-conserving musculature
   9. general-purpose hands
   10. man-robot voice communications
   11. inherent safety
   12. all these capabilities, available for a price that allows purchase and operation within the traditionally accepted rules for economic justification of any new equipment

F. Uses in construction
   1. Some robots are designed to handle only a few grams, while others can cope with as much as 1000 KG.
   2. For the most part, robots are used on one sequence of operations, which is then repeated over and over again.
   3. In most cases, a robot can perform the same tasks more reliably.
   4. Robots can outperform humans in hostile working environments, where noise, vibration, smells, or danger act adversely on the physiological system.
   5. Robots do not have to stop to eat, take coffee breaks, or change shifts.
   6. Robots do not get tired, need sleep, or have a family to go home to.
   7. Robots can be designed with much more muscle power than humans.
   8. Many tools can be attached to the end of the robot arm.

MATERIALS FOR STUDENTS

- Vocabulary worksheet
- Computer programs

SUGGESTED STUDENT ACTIVITIES

1. Have students work on and develop computer programs related to construction management.
2. Have students work on and develop CAD programs related to construction.
3. Have a robotics representative speak to class on how robots are used in the construction industry.
4. Have students give examples of how computers are used in the construction industry.
5. Have students write a report on a topic of their choice related to computer applications in the construction industry.
6. Have students apply computer applications to other relevant student activities in this guide.

Vocabulary Worksheet

1. special-purpose computers
2. general-purpose computers
3. computer programs
4. microcomputers
5. robotics

TEST

Unit 8: Computer Applications In Construction

Directions: Read each statement carefully. Select the word or phrase that correctly answers or completes the statement, and write the appropriate letter in the blank.

Example: __D__ 21. The class that you are in is—
A. Science
B. English
C. Art
D. Industrial Arts

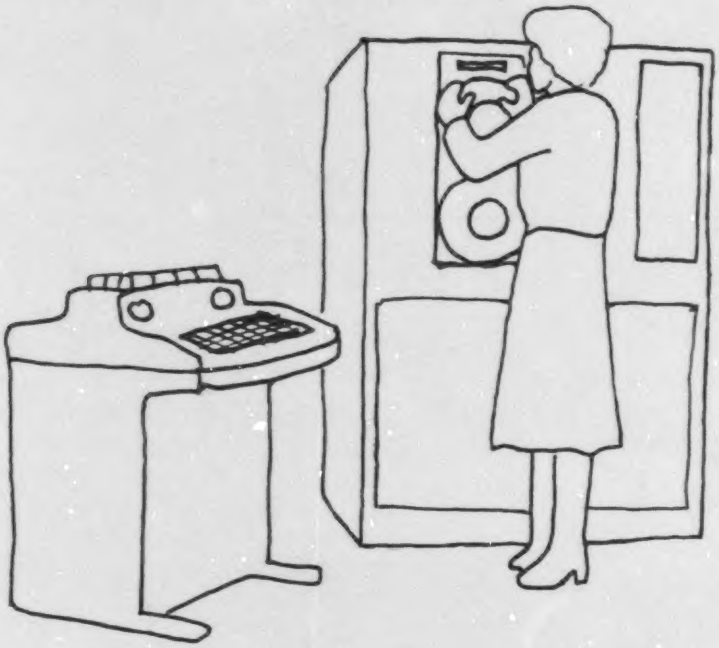
___ 1. Special-purpose computers—
A. outnumber general-purpose computers
B. are few in number in comparison to general-purpose computers
C. are equal in number to general-purpose computers
D. none of the above

___ 2. General-purpose computers—
A. can do a variety of jobs
B. can do only one job
C. are not programmable
D. all of the above

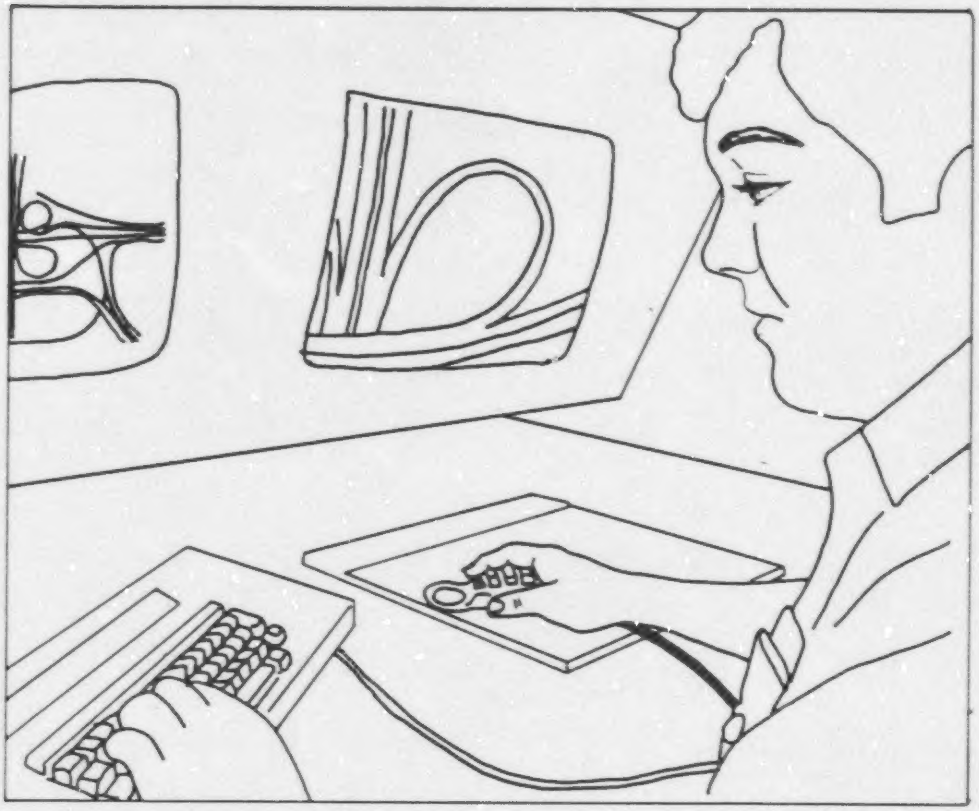
___ 3. Computer instructions are called—
A. directions
B. lessons
C. programs
D. assignments

___ 4. Computers that are smaller than the average desk are called—
A. megacomputers
B. millicomputers
C. monocomputers
D. microcomputers

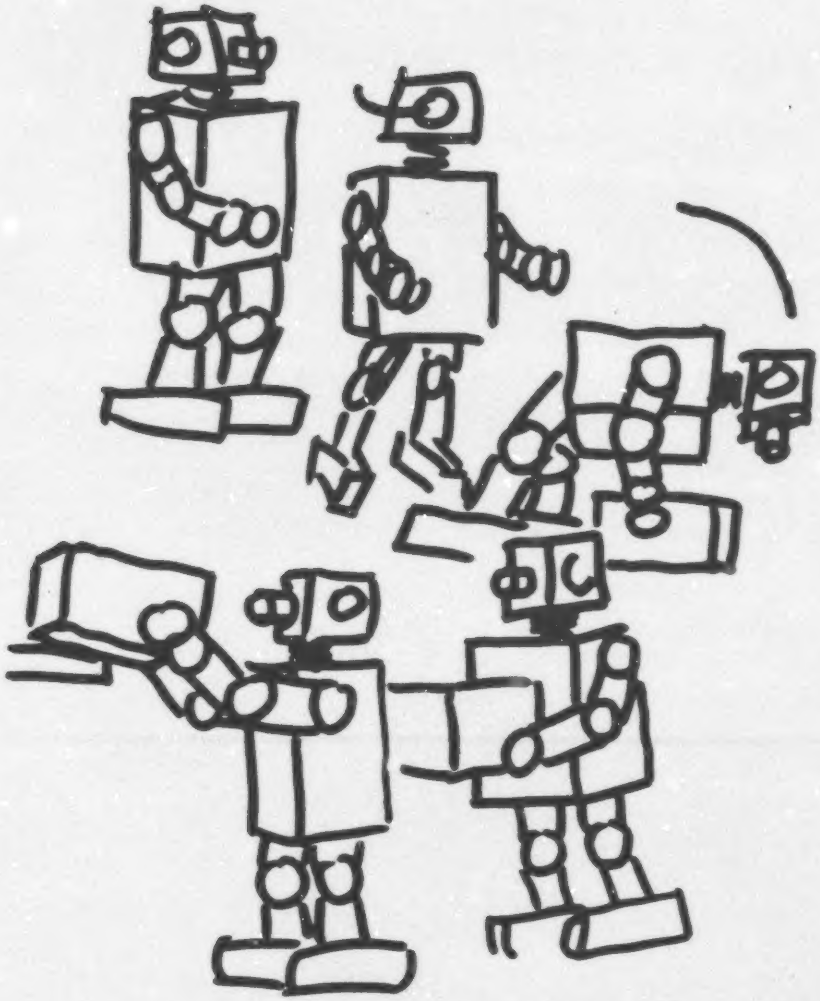
CONSTRUCTION MANAGEMENT APPLICATIONS



COMPUTER-AIDED DESIGN



ROBOTICS IN CONSTRUCTION



Appendix A / References, Films, and Pamphlets

Books

Arbib, Michael A. *Computers and Cybernetic Society*. New York: Academic Press, 1977.

Badzinski, Jr., Stanley. *Carpentry in Residential Construction*. Englewood Cliffs, N. J.: Prentice-Hall, 1972.

Bame, E. A., and Cummings, P. *Exploring Technology*. Worchester, Mass.: Davis Publications, 1980.

Betts, M. Roger; Hausenstein, A. Dean; and Fannin, John. *Exploring the Construction Industry*. Bloomington, Ill.: McKnight Publishing Company, 1976.

Cary, Jere. *Building Your Own Kitchen Cabinets*. Newtown, Conn.: Taunton Press, 1983.

Cockrum, J. L. *Painter and Paperhanger*. Austin, Tex.: Extension Instruction and Materials Center, The University of Texas, 1977.

Covvey, H. Dominic, and McAlister, Neil H. *Computer Consciousness: Surviving the Automated Eighties*. Reading, Mass.: Addison-Wesley Publishing Company, 1980.

Feirer, John L., and Hutchings, Gilbert R. *Carpentry and Building Construction*. Peoria, Ill.: Charles A. Bennett Company, 1976.

Goetsch, David L. *The CAD/CAM Workbook*. Cincinnati: South-Western Publishing Company, 1983.

Heiner, Carl W., and Hendrix, Wayne R. *People Create Technology*. Worchester, Mass.: Davis Publications, 1980.

Hepler, Donald E., and Wallach, Paul I. *Architecture Drafting and Design*. New York: McGraw-Hill Book Company, 1977.

Huth, Mark. *Introduction to Construction*. Albany, N. Y.: Delmar Publishers, 1980.

Landers, Jack M. *Construction Materials, Methods, Careers*. South Holland, Ill.: Goodheart-Willcox Company, 1983.

Lux, Donald G.; Ray, Willis E.: Blankenbaker, E. Keith; and Umstattd, William. *World of Construction*. Bloomington, Ill.: McKnight Publishing Company, 1982.

Notgrass, Troy. *Plumber*. Austin, Tex.: Extension Instruction and Materials Center, The University of Texas, 1982.

Sanders, Donald H. *Computers in Society*. New York: McGraw-Hill Book Company, 1977.

Sutton, Mark C. *Building Maintenance Repairer*. Austin, Tex.: Extension Instruction and Materials Center, The University of Texas, 1974.

Weiss, Eric. *Computer Usage-Applications*. New York: McGraw-Hill Book Company, 1970.

Willis, Jerry, and Miller, Merl. *Computers for Everybody*. Beaverton, Ore.: Dilithium Press, 1981.

Wyatt, William E. *General Architectural Drafting*. Peoria, Ill.: Charles A. Bennett Company, Inc. 1976.

Magazines

Homebuilding Business, P. O. B[illegible] 1933, Clinton, Iowa 52732.
Constructor, 1957 E. Street, N. W. Washington, D. C. 20006.
Better Homes and Gardens, Box 451, Des Moines, Iowa 50336.

Career Information, Reports, and Agencies

American Federation of Labor and Congress of Industrial Organizations, Building and Construction Trades Department, 815 16th Street, N. W., Washington, D. C. 20006.

Associated General Contractors of America, Inc., 1957 E. Street, N. W., Washington, D. C. 20006.

Bureau of Labor Statistics, Occupational Outlook Handbook and the National Career Information Center, a service of the American Personnel and Guidance Association, 1607 New Hampshire Ave., N. W., Washington, D. C. 20009.

Capital Report Service, 1700 Rio Grande, Austin, Texas.

Careers, Inc., Box 135, 1211 10th Street, S. W. Largo, Florida 33540.

Careers in Construction, Teacher's manual. Pathescope Educational Films, Inc.

Conservation and Renewable Energy Inquiry and Referral Service, P. O. Box 8900, Silver Springs, Maryland 20907.

Energy Conservation and Renewable Resources, 311 E. 14th Street, Austin, Texas.

F. W. Dodge, Division of McGraw-Hill, 3445 Executive Center Drive, Austin, Texas.

Hands to Build America, National Housing Center Council, 1625 L Street, N. W. Washington, D. C. 20036.

Hopke, William E., editor-in-chief, Encyclopedia of Careers and Vocational Guidance, J. F. Ferguson Publishing Company, Chicago (distributed by Doubleday and Company) 1972.

National Association of Home Builders, 1625 L Street, N. W., Washington, D. C. 20036.

National Solar Heating and Cooling Information Center, P. O. Box 1607, Rockville, Maryland 20850.

Texas State Department of Highways and Public Transportation, 11th and Brazos, Austin, Texas.

Top Hand in the Building Trades, Carpentry as a Career, National Lumber Manufacturers Association.

Whitney and Siddons, 1700 Rio Grande, Austin, Texas.

Manuals

Achievement Program. Reston, Va.: American Industrial Arts Association, 1983.

AIASA Guide for Industrial Arts Program Standards for Industrial Arts Programs. Blacksburg, Va.: Virginia Polytechnic Institute and State University, November, 1981.

Barnes, James L. "American Industrial Arts Student Association Student Record Book." Unpublished research, Virginia Polytechnic Institute and State University, 1983.

CAPP Homes, 3355 Hiawatha Avenue, Minneapolis, Minn. 55406.

Cardinal Points of Correct Frame Construction, Southern Pine Association, New Orleans, La.

Guide II: Student Association Activities in Industrial Arts Instruction. Richmond, Va.: Department of Education, 1979.

Low-Cost Wood Homes for Rural America - Construction Manual. Agriculture Handbook No. 364, U. S. Department of Agriculture Forest Service.

A. Quality Concrete from Small Mixers, Portland Cement Association, Old Orchard Road, Skokie, Ill. 60076.

B. Building with Concrete Masonry, Portland Cement Association, Old Orchard Road, Skokie, Ill. 60076.

Manual for House Framing, National Forest Products Association, 1619 Massachusetts Avenue, N. W., Washington, D. C. 20036.

Selection and Use of Wood Products for Home and Farm Building by Anderson. U. S. Department of Agriculture Forest Service, Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402.

Texas Industrial Arts Student Association, Austin, Tex.: Texas Education Agency, 1975.

Texas Industrial Arts Student Association 1983 Handbook Regional and State Competition. Austin, Tex.: Texas Education Agency, 1983.

Appendix B / List of Materials and Equipment Suppliers

AMSI Miniatures
115-b Bellam Boulevard
San Rafael, CA 94912

Broadhead-Garrett Company
4560 E. 71st Street
Cleveland, OH 44105

Cir-Kit Concepts, Inc.
1714 11th Ave. N. E.
Rochester, NY 55901

Energy Concepts, Inc.
3254 N. Kilbourn Avenue
Chicago, IL 60641

Graves Humphreys, Inc.
1948 Franklin Road
Roanoke, VA 24033

Industrial Arts Supply Company
5724 W. 36th Street
Minneapolis, MN 55416

J. Hermes
P. O. Box 23
El Monte, CA 91734

Mann E-Z Strip Wiring
Stage House Village
Scotch Plain, NJ 07076

Miniature Makers
Evansville, WI 53536

Northeastern Scale Models, Inc.
P. O. Box 425N
Methuen, MA 01844

Paxton/Patterson
5719 W. 65th Street
Chicago, IL 60638

Pitsco, Inc.
1004 E. Adams
Pittsburg, KS 66762

SATCO
924 S. 19th Avenue
Minneapolis, MN 55404

Appendix C / Computer Printouts

Acknowledgments

The following computer programs were developed through a grant to the Department of Technology at Southwest Texas State University, under the direction of Dr. Billy Windham.

Note to the Teacher

The teacher should determine the difficulty level of the following programs and modify them to the appropriate level.

```
5 '    USE THIS PROGRAM TO ASSIGN CHORES TO THE STUDENTS OF A
10 ' CLASS. THE PROGRAM WILL ASK FOR THE NAMES OF THE STUDENTS
15 ' AND CHORES ONCE AND THEN SAVE THEM ON DISK. YOU CAN
20 ' CHANGE THEM ANYTIME YOU RUN THE PROGRAM AND THE CORRECT
25 ' VERSION IS SAVED WHEN YOU EXIT THE PROGRAM.
30 '    THE PROGRAM WILL RANDOMLY ASSIGN CHORES TO STUDENTS
35 ' SO THERE IS LITTLE POSSIBILITY OF THE SAME STUDENT BEING
40 ' ASSIGNED THE SAME CHORE ON CONSECUTIVE DAYS.
45 '
100 CLEAR 5000
105 ON ERROR GOTO 500
110 DIM CL$(40),AS(40),CH$(40)
115 OPEN "I",1,"CHORES/EMP"
120 J = 0:W = 0
130 IF EOF(1) THEN 155
132 INPUT#1,CL$(J)
135 IF CL$(J) = "END" THEN 150
140 J = J + 1:GOTO 130
145 GOTO  500
150 IF (EOF(1) OR  CH$(W)="END" ) THEN 155
151 INPUT#1,CH$(W)
152 W = W + 1:GOTO 150
153 W = W-1:J = J-1
155 CLS:PRINT@145,"THE CLASS CHORE ASSIGNMENT PROGRAM"
160 PRINT@267,"CLASSROOM CHORES ARE ASSIGNED IN A RANDOM ORDER."
165 PRINT"THE NAMES AND CHORES ARE STORED ON DISK AFTER THEY ARE
    ENTERED  WITH THE FIRST USE."
167 GOSUB 4000                            ' **** WAIT LOOP
170 '
175 GOSUB 1000                     ' ASK FOR ANY CHANGES
180 '
185 IF A$<>"N" THEN 160
190 GOSUB 2500                     ' MAKE RANDOM ASSIGNMENTS
195 GOSUB 3000                     ' ASK IF PRINTOUT IS WANTED
200 GOSUB 3500                     ' EXIT?
205 IF A = 1 THEN 190
210 GOTO 5000                      ' CALL EXIT
215 '
220 '
500 CLS:PRINT"                                THE STUDENT ROLE":PRINT@139,
    "HOW MANY STUDENTS ARE IN THE CLASS?"
505 PRINT@267,"PLEASE PRESS ENTER AFTER YOUR ANSWER."
510 FOR I = 0 TO 40:CL$(I)="                         ":CH$="      ":NEXT I
512 INPUT J
515 IF J<2 OR J>40 THEN 500
520 CLS:PRINT@133,"TYPE IN THE STUDENTS NAMES AND PRESS ENTER
    AFTER EACH ONE."
525 FOR I = 1 TO J
530   INPUT CL$(I-1)
535 NEXT I
555 '
560 GOSUB 1580                        'PRINT CLASS ON SCREEN
565 GOSUB 4000                        ' **** WAIT LOOP
570 '
575 CLS:PRINT@139,"HOW MANY CHORES ARE THERE TO BE ASSIGNED?"
580 INPUT W
585 IF W < 1 OR W > 40 THEN 575
590 CLS:PRINT@321,"TYPE IN A DESCRIPTION (20 CHARACTERS OR LESS)
    OF EACH CHORE."
```

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600 FOR I = 0 TO W - 1
605   INPUT CH$(I)
610 NEXT I
615 K = INT(.5+W/2):GOSUB 900
620 GOSUB 4000                     ' **** WAIT LOOP
625 GOTO 155
630 '
900 ' THIS ROUTINE LIST THE CLASS CHORES.
905 CLS:L=0:F=0:N=W-1:CA=0
910 P=N:IF P > 10 THEN P = 10
915 PRINT@75,"     THE CHORE LIST":FOR I = L TO P STEP 2
920      PRINT TAB(5);I+1;CH$(I);TAB(30);I+2;CH$(I+1)
925 NEXT I
930 IF F = 1 THEN 995
935 GOSUB 4200:N = N - 10
940 IF AS$="C" THEN 995
945 IF N < 10 THEN 990
950 L=P:P=P+10
955 FOR I = 128 TO 704 STEP 64:PRINT@I,"
960 GOTO915
990 L=P+1:P=J-1:F=1:GOTO 915
995 RETURN
1000 CLS:PRINT@139,"IF YOU WISH TO MAKE CHANGES IN THE CLASS
     ROLE TYPE C.          IF A CHORE CHANGE IS NEEDED TYPE W."
1005 PRINT@267,"TYPE N IF NO CHANGES ARE NEEDED."
1010 A$ = INKEY$: IF A$ = "" THEN 1010
1015 IF A$ = "N" THEN 1040
1020 IF A$ = "C" THEN GOSUB 1500
1025 IF A$ = "W" THEN GOSUB 2000
1030 GOTO 1000
1035 '
1040 RETURN
1500 ' THIS ROUTINE ALLOWS THE USER TO ALTER THE CLASS ROLE.
1505 GOSUB 1580
1510 PRINT"TYPE :":FOR I = 576 TO 639:PRINT@I," ":NEXTI
1515 PRINT"             1  TO CHANGE A NAME."
1520 PRINT"             2  TO ADD NAMES."
1525 PRINT"             3  TO DELETE NAMES."
1530 INPUT C
1535 IF C < 1 OR C > 3 THEN 1510
1540 '
1545 ON C GOTO 1700,1770,1890
1550 '
1580 PRINT:CLS:L=0:F=0:N=J-1:CA=0
1582 P=N:IF P>10 THEN P=10
1584 CLS:PRINT@75,"     THE CLASS ROLE":PRINT:  FOR I = L TO
     P STEP 2
1586       PRINTTAB(5);I+1;CL$(1);TAB(30);I+2;CL$(I+1)
1588   NEXT I
1590 IF F = 1 THEN 1610
1592 GOSUB 4200:N = N - 10
1593 IF AS$ = "C" THEN 1610
1594 IF N < 10 THEN 1600
1596 L = P :P = P + 10
1597 FOR I = 128 TO 704 STEP 64:PRINT@I,"
1598 GOTO 1584
1600 L = P+1:P = J-1:F = 1:GOTO 1584
1610 RETURN
```

```
1615 '
1620 PRINT@907,"DO YOU WANT TO MAKE ANY MORE CHANGES?"
1625 PRINT"TYPE Y (YES) OR N (NO)."
1630 A$ = INKEY$:IF A$ = "" THEN 1630
1640 RETURN
1645 '
1700 '
1705 PRINT "ENTER THE NUMBER OF THE NAME TO BE CHANGED."
1710 INPUT C
1715 IF C < 1 OR C > 40 THEN 1705
1720 PRINT "TYPE IN THE NEW NAME AND PRESS ENTER."
1725 INPUT CL$(C-1)
1730 GOSUB 4000              ' PRINT CLASS AND WAIT
1745 RETURN
1770 K = 40 - J
1775 CLS:PRINT"THERE ARE ":K:"AVAILABLE AREAS FOR NEW NAMES"
1780 PRINT"HOW MANY NEW NAMES ARE TO BE ADDED?"
1785 INPUT L
1790 IF L > K THEN 1770
1795 PRINT "TYPE IN EACH NAME AND PRESS ENTER."
1800 FOR I = J TO J+L-1
1805   INPUT CL$(I)
1810 NEXT I
1815 J = J + L
1820 '
1825 GOSUB 1620
1835 IF A$ = "Y" THEN 1505
1840 RETURN
1890 '
1895 '
1900 '
1915   PRINT"ENTER THE NUMBER OF THE NAME TO BE DELETED."
1920   INPUT L
1925   FOR N = L TO J-1
1930     CL$(N-1) = CL$(N)
1940     J = J - 1
1945   NEXT N
1947 CL$(J) = "                          "
1955 '
1965 GOSUB 1620
1970 IF A$ = "Y" THEN 1505
1975 RETURN
2000 GOSUB 900                          ' PRINT CHORES
2005 PRINT" TYPE IN :"
2010 PRINT"               1  TO CHANGE A CHORE."
2015 PRINT"               2  TO ADD CHORES."
2020 PRINT"               3  TO DELETE CHORES."
2025 '
2030 INPUT C
2035 IF C < 1 OR C > 3 THEN 2000
2040 ON C GOTO 2100,2200,2300
2100 '
2105 PRINT"ENTER THE NUMBER OF THE CHORE TO BE CHANGED."
2110 INPUT C
2115 IF C < 0 OR C > 40 THEN 2000
2120 PRINT " TYPE IN THE NEW CHORE AND PRESS ENTER."
2125 INPUT CH$(C-1)
```

```
2130 '
2135 GOSUB 1620                    ' ASK FOR MORE CHANGES
2140 IF A$ = "Y" THEN 2000
2145 RETURN
2150 '
2200 CLS:K = 40 - W
2205 PRINT " THERE ARE ";K;" AVAILABLE AREAS FOR NEW CHORES."
2210 PRINT " HOW MANY NEW CHORES ARE TO BE ADDED?"
2215 INPUT L
2220 IF L > K THEN 2200
2225 PRINT " TYPE IN EACH NEW CHORE AND PRESS ENTER."
2230 FOR I = W+1 TO W+L
2235   INPUT CH$(I)
2240 NEXT 1
2245 W = W + L
2250 '
2255 GOSUB 1620
2260 IF A$ = "Y" THEN 2000
2265 RETURN
2270 '
2300 '
2330   PRINT"ENTER THE NUMBER OF THE CHORE TO BE DELETED."
2335   INPUT L
2340   FOR N = L TO W-1
2345     CH$(N-1) = CH$(N)
2355  NEXT N
2360 W = W-1
2363 CH$ = "                          "
2370 '
2375 '
2380 GOSUB 1620
2385 IF A$ = "Y" THEN 2000
2390 RETURN
2395 '
2480 '
2500 ' THIS SECTION MAKES THE RANDON ASSIGNMENTS.
2502 FOR 1 = 0 TO 39:AS(I) = 0:NEXTI
2505 CLS:PRINT@535,"WORKING"
2507 G = 0
2510 FOR I = 0 TO W-1
2515   FLAG = 0:S = RND(0):S = INT (S*(W+1))
2520   FOR K = 0 TO W-1
2525     IF (S=AS(K)) FLAG = 1
2526     PRINT@139." FINDING AN ASSIGNMENT FOR ";CL$(G)
2530   NEXT K
2535   IF FLAG = 1 THEN 2515
2537 PRINT@165,"                          "
2538 G = G + 1:IF G > J-1 THEN G = 0
2540 AS(I) = S:NEXT I
2545 '
2550 RETURN
3000 '    *** LIST  ASSIGNMENTS 10 AT A TIME. ***
3005 '
3010 CLS:L=0:F = 0
3015 N = J-1:CA = 0
3020 P = N: IF P >10 THEN P = 10
3025   FOR I = L TO P
3030      M = AS(CA)
```

```
3035      PRINT TAB(5);CL$(1);TAB(25);CH$(M)
3037     CA = CA + 1:IF CA > W-1 THEN CA = 0
3040   NEXT I
3045 PRINT:PRINT"     MORE ON NEXT PAGE":GOSUB 4000
3050 IF F = 1 THEN 3100
3055 N = N -10
3060 IF N < 10 THEN 3080
3065   L = P+1:P = P+10
3070   GOTO 3025
3075 '
3080 L = P+1:P = J-1:F = 1:GOTO 3025
3100 PRINT:PRINT"    PRESS S TO RELIST THE ASSIGNMENTS OR
     C TO CONTINUE."
3105 E$ = INKEY$: IF E$ <>"S" AND E$ <> "C" THEN 3105 .
3110 IF E$ = "S" THEN 3010
3115 RETURN
3500 CLS:PRINT@139,"ENTER  "
3505 PRINT"                1. TO REASSIGN THE CHORES."
3510 PRINT"                2. TO EXIT AND SAVE THE CHANGES."
3515 PRINT"                3. TO EXIT AND SAVE THE ORIGINAL DATA."
3517 PRINT"                4. TO EXIT AND LIST ON LINE PRINTER."
3520 INPUT A
3525 IF A<>1 AND A<>2 AND A<>3 AND A<>4 THEN 3500
3530 ON A GOTO 3550,3600,3550,3700
3550 RETURN
3600 OPEN "O",1,"CHORES/EMP"
3605 FOR I = 0 TO J-1
3610  PRINT#1,CL$(I)
3615 NEXT I
3616 CL$(J) = "END":PRINT#1,CL$(J)
3617 FOR I = 0 TO W-1
3618 PRINT #1,CH$(I):NEXTI
3619 CH$(W) = "END":PRINT#1,CH$(W)
3620 CLOSE
3625 RETURN
3700 'LIST ON LINE PRINTER
3705 '
3710 LPRINT CHR$(12)
3715   LPRINT TAB(25);" *****  CLASS CHORE ASSIGNMENTS *****"
3720 LPRINT" "
3725 FOR I = 0 TO W-1
3735   LPRINT TAB(15);CL$(1);TAB(50);CH$(AS(1))
3740 NEXTI
3742 LPRINT CHR$(12)
3745 RETURN
4000  ' ************  WAIT FOR USER RESPONSE **********
4005 '
4010 PRINT@967,"PRESS C TO CONTINUE."
4015 S$=INKEY$:IF S$<>"C" THEN 4015
4020 RETURN
4025 '
4030 '
4200 '        *** USER INPUT ON CHANGE  ***
4205 '
4210 PRINT "ENTER P TO SEE MORE OF THE LIST OR C TO CHANGE
     AN ELEMENT SHOWN."
4215 AS$ = INKEY$: IF AS$<>"P" AND AS$<>"C" THEN4215
4220 RETURN
5000 END
```

```
>RUN
METRIC  CONVERSION

1---MILLIMETERS TO INCHES

2---CUBIC CENTEMETERS TO CUBIC INCHES

3---SQ. CM  TO  SQ. INCHES

4---SQ. METERS TO SQ. FEET

5---KILOGRAMS TO POUNDS

6---MILES TO KILOMETERS


S E L E C T   A   N U M B E R  ? 5

ENTER THE NUMBER OF KILOGRAMS  ? 25

THE NUMBER OF POUNDS =   55.115558525

DO YOU WANT ANOTHER CALCULATION ?   YES = 1,  NO = 0?
^C
Break in 290
Ready

>LLIST
10 CLS
20 PRINT"                  METRIC  CONVERSION"
30 PRINT:PRINT
40 REM  BY J.R. MYCUE 1983
50 PRINT        "1---MILLIMETERS TO INCHES"
60 PRINT
70 PRINT        "2---CUBIC CENTEMETERS TO CUBIC INCHES"
80 PRINT
90 PRINT        "3---SQ. CM  TO  SQ. INCHES"
100 PRINT
110 PRINT       "4---SQ. METERS TO SQ. FEET"
120 PRINT
130 PRINT       "5---KILOGRAMS TO POUNDS"
140 PRINT
150 PRINT       "6---MILES TO KILOMETERS"
160 PRINT:PRINT
170 INPUT "S E L E C T   A   N U M B E R  " ; S
180 PRINT
190 IF S=1 THEN GOTO 250
200 IF S=2 THEN GOTO 320
210 IF S=3 THEN GOTO 370
220 IF S=4 THEN GOTO 420
230 IF S=5 THEN GOTO 470
240 IF S=6 THEN GOTO 520
250  INPUT "ENTER THE NUMBER OF MILLIMETERS TO BE CONVERTED";A
260  PRINT
270 PRINT "THE NUMBER OF INCHES =  ";A * .03937
```

```
280 PRINT
290 INPUT "DO YOU WANT ANOTHER CALCULATION ?   YES = 1,  NO = 0";X
300 IF X=1 THEN GOTO 10
310 IF X=0 THEN END
320 INPUT "ENTER THE NUMBER OF CUBIC CENTIMETERS   ";B
330 PRINT
340 PRINT "THE NUMBER OF CUBIC INCHES = ";B * .06102338
350 PRINT
360 GOTO 290
370 INPUT "ENTER THE NUMBER OF SQUARE CENTEMETERS  ";C
380 PRINT
390 PRINT " THE NUMBER OF SQUARE INCHES =  "; C*.15499969
400 PRINT
410 GOTO 290
420 INPUT "ENTER THE NUMBER OF SQUARE METERS  ";D
430 PRINT
440 PRINT "THE NUMBER OF SQUARE FEET =  "; D*10.76387
450 PRINT
460 GOTO 290
470 INPUT "ENTER THE NUMBER OF KILOGRAMS  ";E
480 PRINT
490 PRINT "THE NUMBER OF POUNDS =  ";E * 2.204622341
500 PRINT
510 GOTO 290
520 INPUT "ENTER THE NUMBER OF MILES  ";F
530 PRINT
540 PRINT "THE NUMBER OF KILOMETERS = "; F * 1.6093472
550 PRINT
560 GOTO 290
Ready
>
```

CONVERSIONS

The first set of programs we have are convertion programs. They convert from English measure to Metric. These are very simple and easy to type in programs.

The first program is "INCHES TO CENTIMETERS". This program converts inches to centimeters. While typing it in you do not have to type the "REM", or "REMARK", statements. They are there simply to let you know what the program is doing at a given point.

This program first reads in the number of inches to be converted. Then it converts them, and finally it prints out the convertion. For example, say you wanted to find out how many centimeters are in a yard strick. You would enter 36 for the number of inches and the program would output the convertion.

Here then is a sample run and a listing of the program.

```
LOAD INCHES TO CENTIMETERS,D1
]RUN


    ENTER THE NUMBER OF INCHES TO BE
CONVERTED TO CENTIMETERS, IN DECIMAL
FORM?36


    36 INCHES = 91.44 CENTIMETERS.


    A = ANOTHER   E = END

]LIST

10  REM CHANGE INCHES TO
20  REM CENTIMETERS.
30  REM
35  HOME : PRINT : PRINT : PRINT

40  REM INPUT # OF INCHES
50  PRINT  TAB( 5)"ENTER THE NUMB
     ER OF INCHES TO BE"
60  PRINT "CONVERTED TO CENTIMETE
     RS, IN DECIMAL"
65  PRINT "FORM";: INPUT I
70  REM CONVERT TO CENTIMETERS
80 C = I * 2.54
90  REM OUTPUT ANSWER
100  PRINT : PRINT : PRINT
110  PRINT  TAB( 5)I;" INCHES = "
     ;C;" CENTIMETERS."
120  PRINT : PRINT : PRINT
130  PRINT  TAB( 5)"A = ANOTHER
      E = END"
140  GET A$
150  IF A$ = "A" GOTO 35
160  END

]
```

```
 RADIO SHACK  TRS-80 AUTHOR I      Lesson: TEXT1
Version: 01/10/84        Page: 07 of 12   Page type: TEXT

------------------------------------------------------------------
!   .      PROGRAM 4. SUPPLY INVENTORY AND ACCOUNTS             !
!   .                                                           !
!   .       This is a very useful program that can help         !
!   .     manage a school wood or metal shop, art class,        !
!   .     or any situation where students use supplies          !
!   .     that are inventoried and charged to the user.         !
!   .                                                           !
!   .       The student roster must be entered as well as       !
!   .     the inventory items, amount in stock, unit of         !
!   .     charge and price per unit. This information is        !
!   .     saved on disk upon normal exit from the program       !
!   .     and all changes made during an entry session are      !
!   .     also recorded.                                        !
------------------------------------------------------------------
```

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```
 RADIO SHACK  TRS-80 AUTHOR I      Lesson: TEXT1
Version: 01/10/84       Page: 08 of 12   Page type: TEXT

-------------------------------------------------------------------
!    .      The program is pretty self-explanatory as             !
!    .    you step through the sections.  These                   !
!    .    sessions include facilities change all data,            !
!    .    add newly received stock, request material              !
!    .    and bill an account for uninventoried material.         !
!    .                                                            !
!    .      When material is requested it is automatically        !
!    .    deducted from inventory, the cost figured and           !
!    .    then charged to the appropriate account.                !
!    .                                                            !
!    .      The program uses disk 0 to store data in a file       !
!    .    called SHOP/DAT.                                        !
!    .                                                            !
-------------------------------------------------------------------
```

```
 RADIO SHACK  TRS-80 AUTHOR I      Lesson: TEXT1
Version: 01/10/84        Page: 09 of 12   Page type: TEXT

------------------------------------------------------------------
!    .      PROGRAM 5. RECYCLING ACCOUNT FILE                      !
!    .                                                             !
!    .      This program will help maintain accounts               !
!    .    of how much money each student has earned in             !
!    .    collecting recylable materials.  The program             !
!    .    is originaly set up to work for aluminum cans            !
!    .    at 30 cans a pound and 31 cents per pound.               !
!    .    This can be changed by altering lines 520                !
!    .    through 550 to the appropriate values.                   !
!    .                                                             !
!    .      After entering the class role on the first             !
!    .    use, the data is saved on disk 0 and is reloaded         !
!    .    whenever the program is run.                             !
------------------------------------------------------------------
```

```
 RADIO SHACK  TRS-80 AUTHOR I      Lesson: TEXT1
Version: 01/10/84        Page: 10 of 12   Page type: TEXT

--------------------------------------------------------------------------
!    .      To record what a student brings in as recyclable           !

!    .    material, select 2 on the main menu.  Step through           !

!    .    the class role until the students name appears               !

!    .    and then press A.  The program will then ask for             !

!    .    the number of cans recovered. After receivig this,           !

!    .    the program will figure the dollar value of the              !

!    .    material and credit the student account.                     !

!    .                                                                 !

!    .      All current dollar values are also saved on disk.          !

!    .                                                                 !

!    .                                                                 !

!    .                                                                 !

!    .                                                                 !
--------------------------------------------------------------------------
```

The second program is "INCHES TO MM" (MM means milimeters). This program converts inches to milimeters. It first ask for the number of inches to be converted. Then it converts to milimeters, and finally it outputs the convertion. For example, say you have a six-inch ruler and you wanted to know how many milimeters are in the ruler. You would input 6 to the program and it would output the convertion to milimeters.

Here is a sample run and listing of the program.

```
LOAD INCHES TO MM
]RUN



    ENTER THE NUMBER OF INCHES TO BE
CONVERTED TO MM, IN DECIMAL FORM?6



    6 INCHES = 152.4 MILIMETERS.



    A = ANOTHER   E = END

]LIST

10  REM CHANGE INCHES TO
20  REM MILIMETERS.
30  REM
35  HOME : PRINT : PRINT : PRINT

40  REM INPUT # OF INCHES
50  PRINT  TAB( 5)"ENTER THE NUMB
     ER OF INCHES TO BE"
60  PRINT "CONVERTED TO MM, IN DE
     CIMAL FORM";: INPUT I
70  REM CONVERT TO MILIMETERS
80 MM = I * 25.4
90  REM OUTPUT ANSWER
100  PRINT : PRINT : PRINT
110  PRINT  TAB( 5)I;" INCHES = "
     ;MM;" MILIMETERS."
120  PRINT : PRINT : PRINT
130  PRINT  TAB( 5)"A = ANOTHER
      E = END"
140  GET A$
150  IF A$ = "A" GOTO 35
160  END

]
```

The third program is "FEET TO CM". This program converts feet to centimeters. It first reads in the number of feet. Then it convert them to centimeters, and finally it outputs the convertion. An example would be if you wanted to no how many centimeters are in a square(100 square feet). You would first type in 100 for the number of feet, then the program would output the convertion to centimeters.

Here is a sample run and listing of the program.

```
RUN FEET TO CM



    ENTER THE NUMBER OF FEET TO BE
CONVERTED TO CM, IN DECIMAL FORM?100



    100 FEET = 3048 CENTIMETERS.



    A = ANOTHER   E = END

]LIST

10  REM CONVERT FEET TO CM
20  REM
30  REM INPUT THE # OF FEET
35  HOME : PRINT : PRINT : PRINT

40  PRINT  TAB( 5)"ENTER THE NUMB
     ER OF FEET TO BE"
50  PRINT "CONVERTED TO CM, IN DE
     CIMAL FORM";: INPUT F
60  REM CONVERT TO CM
70 CM = F * 30.48
80  REM OUTPUT CONVERTION
85  PRINT : PRINT : PRINT
90  PRINT  TAB( 5)F;" FEET = ";CM
     ;" CENTIMETERS."
100  PRINT : PRINT : PRINT
110  PRINT  TAB( 5)"A = ANOTHER
      E = END"
120  GET A$
130  IF A$ = "A" GOTO 35
140  END

]
```

The next program is "FEET TO METERS". This program will read in the number of feet to be converted, then it will convert them to meters, and finally it will output the convertion. For example, say you wanted to know how many meters there are from the floor to an eight foot cieling is. You would enter 8, and the program would output the number of meters there are in eight feet.

Here is a sample run and listing of the program.

```
RUN FEET TO METERS



    ENTER THE NUMBER OF FEET TO BE
CONVERTED TO METERS?8



    8 FEET = 2.4384 METERS.



    A = ANOTHER   E = END

]LIST

10  REM CONVERT FEET TO METERS
20  REM
30  REM INPUT THE # OF FEET
40  HOME : PRINT : PRINT : PRINT

50  PRINT  TAB( 5)"ENTER THE NUMB
     ER OF FEET TO BE"
60  PRINT "CONVERTED TO METERS";:
      INPUT F
70  REM CONVERT TO METERS
80 M = F * .3048
90  REM OUTPUT CONVERTION
100  PRINT : PRINT : PRINT
110  PRINT  TAB( 5)F;" FEET = ";M
      ;" METERS."
120  PRINT : PRINT : PRINT
130  PRINT  TAB( 5)"A = ANOTHER
       E = END"
140  GET A$
150  IF A$ = "A" GOTO 40
160  END

]
```

The next program is "YARDS TO CM". This program converts yards to centimeters. It will first read in the number of yards, then convert them to centimeters, and finally output the convertion. For example say you wanted to know how many centimeters are in three yards of fabric. You would enter three as the number of yards to be converted and the program would report the convertion to centimeters.

Here is a sample run and listing of the program.

```
RUNYARDS TO CM



    ENTER THE NUMBER OF YARDS TO BE
CONVERTED TO CM, IN DECIMAL FORM?3



    3 YARDS = 274.32 CENTIMETERS.



    A = ANOTHER   E = END

]LIST

10  REM CONVERT YARDS TO CM
20  REM
30  REM INPUT THE # OF YARDS
40  HOME : PRINT : PRINT : PRINT

50  PRINT  TAB( 5)"ENTER THE NUMB
     ER OF YARDS TO BE"
60  PRINT "CONVERTED TO CM, IN DE
     CIMAL FORM";: INPUT Y
70  REM CONVERT TO CM
80 CM = Y * 91.44
90  REM OUTPUT CONVERTION
100  PRINT : PRINT : PRINT
110  PRINT  TAB( 5)Y;" YARDS = ";
     CM;" CENTIMETERS."
120  PRINT : PRINT : PRINT
130  PRINT  TAB( 5)"A = ANOTHER
      E = END"
140  GET A$
150  IF A$ = "A" GOTO 40
160  END

]
```

the next program is "YARDS TO METERS". This program will convert yards to meters. First it reads in the number of yards to be converted, then it converts them to meters, and finally it outputs the convertion. An example would be if you wanted to know how many meters are in the 100 yard dash. You would first enter 100 as the number of yards to be converted, then the program would output the convertion in meters.

Here is a sample run and listing of the program.

```
RUN YARDS TO METERS



    ENTER THE NUMBER OF YARDS TO BE
CONVERTED TO METERS, IN DECIMAL FORM?100



    100 YARDS = 91.44 METERS.



    A = ANOTHER   E = END

]LIST

10  REM CONVERT YARDS TO METERS
20  REM
30  REM INPUT THE # OF YARDS
40  HOME : PRINT : PRINT : PRINT

50  PRINT  TAB( 5)"ENTER THE NUMB
     ER OF YARDS TO BE"
60  PRINT "CONVERTED TO METERS, I
     N DECIMAL FORM";: INPUT Y
70  REM CONVERT TO METERS
80 M = Y * .9144
90  REM OUTPUT CONVERTION
100  PRINT : PRINT : PRINT
110  PRINT  TAB( 5)Y;" YARDS = ";
     M;" METERS."
120  PRINT : PRINT : PRINT
130  PRINT  TAB( 5)"A = ANOTHER
      E = END"
140  GET A$
150  IF A$ = "A" GOTO 40
160  END

]
```

The next program is "MILES TO METERS". This program will read in the number of miles, convert them to meters, and output the convertion. An example would be determining the number of meters in a mile. To do this you would enter 1 as the number of miles to be converted, then the program would output the number of meters in a mile.

Here is a sample run and listing of the program.

```
RUN MILES TO METERS



    ENTER THE NUMBER OF MILES TO BE
CONVERTED TO METERS, IN DECIMAL FORM?1



    1 MILES = 1609.344 METERS.



    A = ANOTHER   E = END

]LIST

10  REM CONVERT MILES TO METERS
20  REM
30  REM INPUT THE # OF MILES
40  HOME : PRINT : PRINT : PRINT

50  PRINT  TAB( 5)"ENTER THE NUMB
     ER OF MILES TO BE"
60  PRINT "CONVERTED TO METERS, I
     N DECIMAL FORM";: INPUT MI
70  REM CONVERT TO METERS
80 ME = MI * 1609.344
90  REM OUTPUT CONVERTION
100  PRINT : PRINT : PRINT
110  PRINT  TAB( 5)MI;" MILES = "
     ;ME;" METERS."
120  PRINT : PRINT : PRINT
130  PRINT  TAB( 5)"A = ANOTHER
      E = END"
140  GET A$
150  IF A$ = "A" GOTO 40
160  END

]
```

The next program is "MILES TO KILOMETERS". This program will convert miles to kilometers. It first reads in the number of miles, then converts them to kilometers, and finally outputs the convertion. For instance say you had to go on a trip of 512 miles, and you wanted to know how many kilometres it would be. To determine this you would enter 512 and the program would output the convertion in kilometers.

Here is a sample run and listing of the program.

```
RUN MILES TO KILOMETERS



    ENTER THE NUMBER OF MILES TO BE
CONVERTED TO KILOMETERS, IN DECIMAL
FORM?512



    512 MILES = 823.984128 KILOMETERS.



    A = ANOTHER   E = END

]LIST

10  REM CONVERT MILES TO
15  REM KILOMETERS
20  REM
30  REM INPUT THE # OF MILES
40  HOME : PRINT : PRINT : PRINT

50  PRINT  TAB( 5)"ENTER THE NUMB
     ER OF MILES TO BE"
60  PRINT "CONVERTED TO KILOMETER
     S, IN DECIMAL"
65  PRINT "FORM";: INPUT M
70  REM CONVERT TO KILOMETERS
80 K = M * 1.609344
90  REM OUTPUT CONVERTION
100  PRINT : PRINT : PRINT
110  PRINT  TAB( 5)M;" MILES = ";
     K;" KILOMETERS."
120  PRINT : PRINT : PRINT
130  PRINT  TAB( 5)"A = ANOTHER
      E = END"
140  GET A$
150  IF A$ = "A" GOTO 40
160  END

]
```

The next program is "CENTIMETERS TO INCHES". This program converts centimeters to inches. It will read in the number of centimeters, then convert them to inches, and finally output the convertion. For instance, say you wanted to know how many inches were in the diameter of a circle, if the circle had a diameter of 6 centimeters. You could find this out by running the program and entering 6 as the number of centimeters to be converted. The progam would output the number of inches in 6 centimteres.

Here is a sample run and listing of the program.

```
RUN CENTIMETERS TO INCHES



    ENTER THE NUMBER OF CENTIMETES
TO BE CONVERTED TO INCHES, IN DECIMAL?6



    6 CENTIMETER = 2.3622 INCHES.



    A = ANOTHER   E = END

]LIST

10  REM CONVERT CENTIMETERS TO IN

20  REM INPUT THE # OF
30  REM CENTIMETERS
40  HOME : PRINT : PRINT : PRINT

50  PRINT  TAB( 5)"ENTER THE NUMB
     ER OF CENTIMETES"
60  PRINT "TO BE CONVERTED TO INC
     HES, IN DECIMAL";: INPUT C
70  REM CONVERT TO INCHES
80 I = C * .3937
90  REM OUTPUT CONVERTION
100  PRINT : PRINT : PRINT
110  PRINT  TAB( 5)C;" CENTIMETER
      = ";I;" INCHES."
120  PRINT : PRINT : PRINT
130  PRINT  TAB( 5)"A = ANOTHER
      E = END"
140  GET A$
150  IF A$ = "A" GOTO 40
160  END

]
```

The next program is "CENTIMETERS TO FEET". This program will convert centimeters to feet. It will read in the number of centimters to be converted, convert them to feet and output the convertion. An example would be if you wanted to know how many feet are in 500 square centimeters. You could find this out by entering 500 as the number of centimeters to be converted to feet. The program would output the number of feet in 500 centimeters.

Here is a sample run and listing of the program.

```
RUN CENTIMETERS TO FEET



    ENTER THE NUMBER OF CENTIMETES
TO BE CONVERTED TO FEET, IN DECIMAL?500



    500 CENTIMETERS = 16.4041995 FEET.



    A = ANOTHER   E = END

]LIST

10  REM CONVERT CENTIMETERS TO FT

20  REM INPUT THE # OF
30  REM CENTIMETERS
40  HOME : PRINT : PRINT : PRINT

50  PRINT  TAB( 5)"ENTER THE NUMB
     ER OF CENTIMETES"
60  PRINT "TO BE CONVERTED TO FEE
     T, IN DECIMAL";: INPUT C
70  REM CONVERT TO FEET
80 F = C / 30.48
90  REM OUTPUT CONVERTION
100  PRINT : PRINT : PRINT
110  PRINT  TAB( 5)C;" CENTIMETER
     S = ";F;" FEET."
120  PRINT : PRINT : PRINT
130  PRINT  TAB( 5)"A = ANOTHER
      E = END"
140  GET A$
150  IF A$ = "A" GOTO 40
160  END

]
```

The next program is "METERS TO FEET". This program will read in the number of meters, convert them to feet, and output the convertion. For instance, say you wanted to know how many feet are in 100 meters. You would enter 100 and the program would output the number of feet.

Here is a sample run and listing of the program.

```
RUN METERS TO FEET



    ENTER THE NUMBER OF METERS TO BE
CONVERTED TO FEET, IN DECIMAL FORM?100



    100 METERS = 328.1 FEET.



    A = ANOTHER    E = END

]LIST

10  REM CONVERT METERS TO FEET
20  REM
30  REM INPUT THE # OF METERS
40  HOME : PRINT : PRINT : PRINT

50  PRINT  TAB( 5)"ENTER THE NUMB
     ER OF METERS TO BE"
60  PRINT "CONVERTED TO FEET, IN
     DECIMAL FORM";: INPUT M
70  REM CONVERT TO FEET
80 F = M * 3.281
90  REM OUTPUT CONVERTION
100  PRINT : PRINT : PRINT
110  PRINT  TAB( 5)M;" METERS = "
     ;F;" FEET."
120  PRINT : PRINT : PRINT
130  PRINT  TAB( 5)"A = ANOTHER
     E = END"
140  GET A$
150  IF A$ = "A" GOTO 40
160  END

]
```

The next program is "METERS TO YARDS". This program will read in the number of meters to be converted, convert them to yards, and output the convertion. For instance, say you wanted to know how many yards are in the 300 meter High Herdles. You would enter 300 and the program would output the number of yards.

Here is a sample run and listing opf the program.

```
RUN METERS TO YARDS



    ENTER THE NUMBER OF METERS TO BE
CONVERTED TO YARDS, IN DECIMAL FORM?300



    300 METERS = 328.2 YARDS.



    A = ANOTHER   E = END

]LIST

10  REM CONVERT METERS TO YARDS
20  REM
30  REM INPUT THE # OF METERS
40  HOME : PRINT : PRINT : PRINT

50  PRINT  TAB( 5)"ENTER THE NUMB
     ER OF METERS TO BE"
60  PRINT "C0NVERTED TO YARDS, IN
      DECIMAL FORM";: INPUT M
70  REM CONVERT TO YARDS
80 Y = M * 1.094
90  REM OUTPUT CONVERTION
100  PRINT : PRINT : PRINT
110  PRINT  TAB( 5)M;" METERS = "
     ;Y;" YARDS."
120  PRINT : PRINT : PRINT
130  PRINT  TAB( 5)"A = ANOTHER
      E = END"
140  GET A$
150  IF A$ = "A" GOTO 40
160  END

]
```

The next program is "KILOMETERS TO YARDS". This program will read in the number of kilometers to be converted, convert them to yards, and output the convertion. An example would be finding the number of yards in a kilometer. You would enter 1, and the program would output the number of yards in a kilometer.

Here is a sample run and listing of the program.

```
RUN KILOMETERS TO YARDS


     ENTER THE NUMBER OF KILOMETERS
TO BE CONVERTED TO YARDS, IN DECIMAL?1



     1 KILOMETERS = 1094 YARDS.



     A = ANOTHER   E = END

]LIST

10  REM CONVERT KILOMETERS TO
15  REM YARDS
20  REM
30  REM INPUT THE # OF
35  REM KILOMETERS.
40  HOME : PRINT : PRINT : PRINT

50  PRINT  TAB( 5)"ENTER THE NUMB
     ER OF KILOMETERS"
60  PRINT "TO BE CONVERTED TO YAR
     DS, IN DECIMAL";: INPUT K
70  REM CONVERT TO YARDS
80 Y = K * 1094
90  REM OUTPUT CONVERTION
100  PRINT : PRINT : PRINT
110  PRINT  TAB( 5)K;" KILOMETERS
      = ";Y;" YARDS."
120  PRINT : PRINT : PRINT
130  PRINT  TAB( 5)"A = ANOTHER
      E = END"
140  GET A$
150  IF A$ = "A" GOTO 40
160  END

]
```

The next program is "KILOMETERS TO MILES". This program will read in the number of kilometers, convert them to miles, and output the convertion. For instance, say you see a distance on a European map of 12 kilometers, and you want to know how many miles that is. You could find this out by running this program, entering twelve for the number of kilometers to be converted, and the program would output the number of miles in 12 kilometers.

Here is a sample run and listing of the program

```
RUN KILOMETERS TO MILES



    ENTER THE NUMBER OF KILOMETERS
TO BE CONVERTED TO MILES, IN DECIMAL?12



    12 KILOMETERS = 7.4568 MILES.



    A = ANOTHER   E = END

]LIST

10  REM CONVERT KILOMETERS TO
15  REM MILES
20  REM
30  REM INPUT THE # OF
35  REM KILOMETERS.
40  HOME : PRINT : PRINT : PRINT

50  PRINT  TAB( 5)"ENTER THE NUMB
     ER OF KILOMETERS"
60  PRINT "TO BE CONVERTED TO MIL
     ES, IN DECIMAL";: INPUT K
70  REM CONVERT TO MILES
80 M = K * .6214
90  REM OUTPUT CONVERTION
100  PRINT : PRINT : PRINT
110  PRINT  TAB( 5)K;" KILOMETERS
      = ";M;" MILES."
120  PRINT : PRINT : PRINT
130  PRINT  TAB( 5)"A = ANOTHER
      E = END"
140  GET A$
150  IF A$ = "A" GOTO 40
160  END

]
```

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The next program is "GALLONS TO LITERS". This program will read in the number of gallons to be converted, convert them to liters, and output the convertion. Say you wanted to determine how many liter coke bottles it would take to fill a gallon milk jug. You could do this by running this program and entering 1 as the number of gallons to be converted. The program would then output the number number of liters it would take to fill a gallon jug.

Here is a sample run and listing of the program.

```
RUN GALLONS TO LITERS



    ENTER THE NUMBER OF GALLONS TO BE
CONVERTED TO LITERS, IN DECIMAL FORM?1



    1 GALLONS = 3.78501136 LITERS.



    A = ANOTHER   E = END

]LIST

10  REM CONVERT GALLONS TO
15  REM LITERS.
20  REM
30  REM INPUT THE # OF GALLONS
40  HOME : PRINT : PRINT : PRINT

50  PRINT  TAB( 5)"ENTER THE NUMB
     ER OF GALLONS TO BE"
60  PRINT "CONVERTED TO LITERS, I
     N DECIMAL FORM";: INPUT G
70  REM CONVERT TO LITERS
80 L = G / .2642
90  REM OUTPUT CONVERTION
100  PRINT : PRINT : PRINT
110  PRINT  TAB( 5)G;" GALLONS =
     ";L;" LITERS."
120  PRINT : PRINT : PRINT
130  PRINT  TAB( 5)"A = ANOTHER
      E = END"
140  GET A$
150  IF A$ = "A" GOTO 40
160  END

]
```

the next program is "LITERS TO GALLONS". This program will read in the number of liters, convert them to gallons and output the convertion. For instance, say your car has a 50 liter gas tank and you want to know how many gallons are in 50 liters. You could determine this by running this program and inputing 50 as the number of liters. The program would then output the number of gallons in 50 liters.

Here is a sample run and listing of the program.

```
RUN LITERS TO GALLONS



    ENTER THE NUMBER OF LITERS TO BE
CONVERTED TO GALLONS, IN DECIMAL FORM?50



    50 LITERS = 13.21 GALLONS.



    A = ANOTHER   E = END

]LIST

10  REM CONVERT LITERS TO
15  REM GALLONS.
20  REM
30  REM INPUT THE # OF LITERS
40  HOME : PRINT : PRINT : PRINT

50  PRINT  TAB( 5)"ENTER THE NUMB
     ER OF LITERS TO BE"
60  PRINT "CONVERTED TO GALLONS,
     IN DECIMAL FORM";: INPUT L
70  REM CONVERT TO GALLONS
80 G = L * .2642
90  REM OUTPUT CONVERTION
100  PRINT : PRINT : PRINT
110  PRINT  TAB( 5)L;" LITERS = "
     ;G;" GALLONS."
120  PRINT : PRINT : PRINT
130  PRINT  TAB( 5)"A = ANOTHER
      E = END"
140  GET A$
150  IF A$ = "A" GOTO 40
160  END

]
```

The next program is "FAHRENHIET TO CELSIUS". This program will read in a temperature in fahrenhiet, convert it to celsius, and output the convertion. Say it is 76 degrees outside and you want to know how many degrees celsius it is. You could determine this by running this program and entering 76 as the temperature. The program will then convert 76 to celsius and output the convertion.

Here is a sample run and listing of the program.

```
RUN FAHRENHEIT TO CELSIUS



    ENTER THE TEMPERATURE IN FAHRENHEIT
DEGREES TO BE CONVERT TO CELSIUS?76



76 DEGREES FAHRENHEIT = 24.444 DEGREES
CELSIUS.



    A = ANOTHER    E = END

]LIST

10  REM CONVERT FAHRENHEIT
15  REM TO CELSIUS.
20  REM
30  REM INPUT TEMPERATURE
40  HOME : PRINT : PRINT : PRINT

50  PRINT  TAB( 5)"ENTER THE TEMP
     ERATURE IN FAHRENHEIT"
60  PRINT "DEGREES TO BE CONVERT
     TO CELSIUS";: INPUT F
70  REM CONVERT
80 C = 5 * (F - 32) / 9
85 C =  INT (C * 1000 + .5) / 100
     0
90  REM OUTPUT CONVERTION
100  PRINT : PRINT : PRINT
110  PRINT F;" DEGREES FAHRENHEIT
      = ";C;" DEGREES"
115  PRINT "CELSIUS."
120  PRINT : PRINT : PRINT
130  PRINT  TAB( 5)"A = ANOTHER
      E = END"
140  GET A$
150  IF A$ = "A" GOTO 40
160  END

]
```

the next program is "CELSIUS TO FAHRENHIET". This program will read in the temperature in celsius, convert it to fahrenhiet, and output the convertion. An example would be if you have a reading of 24 degrees off a cemical and wanted to know what the temperature of the cemical in fahrenhiet is. You could run this program, enter 24, and the program would output the convertion.

Here is a sample run and listing of the program.

```
RUN CELSIUS TO FAHRENHEIT



    ENTER THE TEMPERATURE IN CELSIUS TO
BE CONVERTED TO FAHRENHEIT?24



    24 DEGREES CELSIUS = 75.2 DEGREES
FAHRENHEIT.



    A = ANOTHER   E = END

]LIST

10  REM CONVERT CELSIUS TO
15  REM FAHRENHEIT.
20  REM
30  REM INPUT TEMPERATURE
40  HOME : PRINT : PRINT : PRINT

50  PRINT  TAB( 5)"ENTER THE TEMP
     ERATURE IN CELSIUS TO"
60  PRINT "BE CONVERTED TO FAHREN
     HEIT";: INPUT C
70  REM CONVERT
80 F = (C * 9) / 5 + 32
90  REM OUTPUT CONVERTION
100  PRINT : PRINT : PRINT
110  PRINT  TAB( 5)C;" DEGREES CE
     LSIUS = ";F;" DEGREES"
115  PRINT "FAHRENHEIT."
120  PRINT : PRINT : PRINT
130  PRINT  TAB( 5)"A = ANOTHER
      E = END"
140  GET A$
150  IF A$ = "A" GOTO 40
160  END

]
```

The next program is "CONVERTIONS". This program will do one of six things and return to the beginning of the program or you can tell it to stop running. The six things are convertions. The convertions or from inches to centimeters, centimeters to inches, feet to meters, meters to feet, yards to meters, and meters to yards.

This program is the culmination of the previous convertion programs. It is written by putting the other programs together in one program. It is controlled by a main menue. The way to use this program is to press the number of the convertion you want. When you do this the program will automaticlly go to the section of code that does that particular convertion.

A note to go with this program is that you can easily expaned it by adding other programs from the collection to this one, and increasing the menue. the parts of this program that do the convertions start at line 1000, and each convertion is 100 lines from the starting point of the one before it. this was done to make it easyer to add to this program.

An exanple of the use of this program would be if you wanted to know how many inches are in 10 centimeters, and how many feet are in 10 meters, and how many meters are in 10 yards. To determine these three convertions You could run the program and first press "2", to convert from cm to inches. Then you would enter 10 for the number of centimeters. The program would output the number of inches and then ask you to "PRESS <RETURN> TO CONTINUE.". When you do press <return> the convertion will disappear, so it might not be a bad idea to write the convertions down on a sheet of paper. Next you would want to press 4, to convert meters to feet. Then you would enter 10 for the number of meters and the program would output the convertion to feet. Press <return> and now you are ready to convert yards to meters, so press 5. Next you will enter 10 for the number of yards. The program will output the number of meters and ask you to press <return>; do it. You would then be ready to stop so press 7 for exit to basic and you are through.

Here then is a sample run and a listing of the program.

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```
RUN CONVERSIONS



         MAIN MENUE

    1 = INCHES TO CM
    2 = CM TO INCHES
    3 = FEET TO METERS
    4 = METERS TO FEET
    5 = YARDS TO METERS
    6 = METERS TO YARDS
    7 = EXIT TO BASIC



    ENTER THE NUMBER OF CM TO BE
CONVERTED TO INCHES, IN DECIMAL FORM?10



    10 CENTIMETERS = 3.93700788 INCHES.



    PRESS <RETURN> TO CONTINUE?

         MAIN MENUE

    1 = INCHES TO CM
    2 = CM TO INCHES
    3 = FEET TO METERS
    4 = METERS TO FEET
    5 = YARDS TO METERS
    6 = METERS TO YARDS
    7 = EXIT TO BASIC

    ENTER THE NUMBER OF METERS TO BE
CONVERTED TO FEET, IN DECIMAL FORM?10

    10 METERS = 32.81 FEET.

    PRESS <RETURN> TO CONTINUE?

         MAIN MENUE

    1 = INCHES TO CM
    2 = CM TO INCHES
    3 = FEET TO METERS
```

```
1680  PRINT : PRINT : PRINT : PRINT
      TAB( 5)"PRESS <RETURN> TO C
     ONTINUE";: INPUT A$
1690  GOTO 40
1700  END

]
```

```
    4 = METERS TO FEET
    5 = YARDS TO METERS
    6 = METERS TO YARDS
    7 = EXIT TO BASIC


    ENTER THE NUMBER OF YARDS TO BE
CONVERTED TO METERS, IN DECIMAL FORM?10


    10 YARDS = 9.144 METERS.


    PRESS <RETURN> TO CONTINUE?


         MAIN MENUE

    1 = INCHES TO CM
    2 = CM TO INCHES
    3 = FEET TO METERS
    4 = METERS TO FEET
    5 = YARDS TO METERS
    6 = METERS TO YARDS
    7 = EXIT TO BASIC

]LIST

10  REM CONVERT INCHES-CM OR
11  REM FEET-METERS OR
12  REM YARDS-METERS
20  REM
30  REM PRINT MENUE
40  HOME : PRINT : PRINT : PRINT

50  PRINT  TAB( 10)"MAIN MENUE"
60  PRINT
70  PRINT  TAB( 5)"1 = INCHES TO
     CM"
80  PRINT  TAB( 5)"2 = CM TO INCH
     ES"
90  PRINT  TAB( 5)"3 = FEET TO ME
     TERS"
100  PRINT  TAB( 5)"4 = METERS TO
      FEET"
110  PRINT  TAB( 5)"5 = YARDS TO
     METERS"
120  PRINT  TAB( 5)"6 = METERS TO
      YARDS"
130  PRINT  TAB( 5)"7 = EXIT TO B
     ASIC"
140  GET A
150  IF A < 1 OR A > 7 THEN  PRINT
     : PRINT : PRINT  TAB( 5)"ILL
     EGAL ENTRY, TRY AGAIN.": PRINT
     : PRINT : PRINT : GOTO 50
160  IF A = 1 GOTO 1100
170  IF A = 2 GOTO 1200
180  IF A = 3 GOTO 1300
190  IF A = 4 GOTO 1400
200  IF A = 5 GOTO 1500
210  IF A = 6 GOTO 1600
220  IF A = 7 GOTO 1700
1100  REM CONVERT INCHES TO CM
1101  REM
1102  REM INPUT THE # OF INCHES
1105  HOME : PRINT : PRINT : PRINT

1110  PRINT  TAB( 5)"ENTER THE NU
     MBER OF INCHES TO BE"
1120  PRINT "CONVERTED TO CM, IN
     DECIMAL FORM";: INPUT I
1130  REM CONVERT TO CENTIMETERS
1140 C = I * 2.54
1150  REM OUTPUT THE CONVERTION
1160  PRINT : PRINT : PRINT
1170  PRINT  TAB( 5)I;" INCHES =
     ";C;" CENTIMETERS."
1180  PRINT : PRINT : PRINT : PRINT
      TAB( 5)"PRESS <RETURN> TO C
     ONTINUE";: INPUT A$
1190  GOTO 40
1200  REM CONVERT CM TO INCHES
1201  REM
1202  REM INPUT THE # OF CM
1205  HOME : PRINT : PRINT : PRINT

1210  PRINT  TAB( 5)"ENTER THE NU
     MBER OF CM TO BE"
1220  PRINT "CONVERTED TO INCHES,
      IN DECIMAL FORM";: INPUT C
1230  REM CONVERT TO INCHES
1240 I = C / 2.54
1250  REM  OUTPUT THE CONVERTION
1260  PRINT : PRINT : PRINT
1270  PRINT  TAB( 5)C;" CENTIMETE
     RS = ";I;" INCHES."
1280  PRINT : PRINT : PRINT : PRINT
      TAB( 5)"PRESS <RETURN> TO C
     ONTINUE";: INPUT A$
1290  GOTO 40
1300  REM **FEET TO METERS**
1301  REM
1302  REM INPUT THE # OF FEET
1305  HOME : PRINT : PRINT : PRINT

1310  PRINT  TAB( 5)"ENTER THE NU
     MBER OF FEET TO BE"
1320  PRINT "CONVERTED TO METERS,
      IN DECIMAL FORM";: INPUT F
1330  REM CONVERT TO METERS
1340 M = F * .3048
1350  REM OUTPUT THE CONVERTION
1360  PRINT : PRINT : PRINT
```

```
1370  PRINT  TAB( 5)F;" FEET = ";
     M;" METERS."
1380  PRINT : PRINT : PRINT : PRINT
      TAB( 5)"PRESS <RETURN> TO C
     ONTINUE";: INPUT A$
1390  GOTO 40
1400  REM **METERS TO FEET**
1401  REM
1402  REM INPUT THE # OF METERS
1405  HOME : PRINT : PRINT : PRINT

1410  PRINT  TAB( 5)"ENTER THE NU
     MBER OF METERS TO BE"
1420  PRINT "CONVERTED TO FEET, I
     N DECIMAL FORM";: INPUT M
1430  REM CONVERT TO FEET
1440 F = M * 3.281
1450  REM OUTPUT THE CONVERTION
1460  PRINT : PRINT : PRINT
1470  PRINT  TAB( 5)M;" METERS =
     ";F;" FEET."
1480  PRINT : PRINT : PRINT : PRINT
      TAB( 5)"PRESS <RETURN> TO C
     ONTINUE";: INPUT A$
1490  GOTO 40
1500  REM **YARDS TO METERS**
1501  REM
1502  REM INPUT THE # OF YARDS
1505  HOME : PRINT : PRINT : PRINT

1510  PRINT  TAB( 5)"ENTER THE NU
     MBER OF YARDS TO BE"
1520  PRINT "CONVERTED TO METERS,
      IN DECIMAL FORM";: INPUT Y
1530  REM CONVERT TO METERS
1540 M = Y * .9144
1550  REM OUTPUT THE CONVERTION
1560  PRINT : PRINT : PRINT
1570  PRINT  TAB( 5)Y;" YARDS = "
     ;M;" METERS."
1580  PRINT : PRINT : PRINT : PRINT
      TAB( 5)"PRESS <RETURN> TO C
     ONTINUE";: INPUT A$
1590  GOTO 40
1600  REM **METERS TO YARDS**
1601  REM
1602  REM INPUT THE # OF METERS
1605  HOME : PRINT : PRINT : PRINT

1610  PRINT  TAB( 5)"ENTER THE NU
     MBER OF METERS TO BE"
1620  PRINT "CONVERTED TO YARDS,
     IN DECIMAL FORM";: INPUT M
1630  REM CONVERT TO YARDS
1640 Y = M * 1.094
1650  REM OUTPUT CONVERTION
1660  PRINT : PRINT : PRINT
1670  PRINT  TAB( 5)M;" METERS =
     ";Y;" YARDS."
```

The next program is "BOARD CONVERT". This program converts board feet to cubic centimeters. This program is here as a kind of footnote to the convertion package. It is meant to demonstrate a method of using convertions in applications programs. An application program is any program that was concieved and written to be applyied, or used, in preforming a given task.

This program will ask you how many inches thick the board is. Then it will ask how many feet wide the board is. Finally it will ask how many feet long the board is. The program will multiply these three input numbers, then convert the product to centimeters and output the convertion. An example would be to determine the cubic centimeters in a 2 by 12. To do this you would run the program, input 2.75 for the thickness, 2 for the width, and 12 for the length. The program would then output the number of cubic centimeters.

Here is a sample run and listing of the program.

```
RUN BOARD CONVERT


            ***BOARD CONVERT***

            DETERMINING BOARD FEET KNOWING  THICKNESS, WIDTH,
            AND LENGTH.


        HOW MANY INCHES THICK IS THE BOARD?2.75


        HOW MANY FEET WIDE IS IT?2


        HOW MANY FEET LONG IS THE BOARD?12


        THE VOLUME OF ONE BOARD IS 167.64
      CUBED CENTIMETERS.

]LIST

10  REM    THIS PROGRAM IS
20  REM DESIGNED TO GET THE I.A.
25  REM STUDENT USE TO USING THE
30  REM COMPUTER TO AID HIM OR
40  REM HER IN DOING HIS OR HER
50  REM PROJECTS.
60  REM
70  REM  THIS PROGRAM WILL
71  REM CONVERT BOARD FEET
80  REM TO BOARD CENTIMETERS.
```

```
205  REM
206  REM
207  HOME : PRINT : PRINT : PRINT

210  PRINT  TAB( 9)"***BOARD CONV
     ERT***": PRINT
220  PRINT  TAB( 9)"DETERMINING B
     OARD FEET KNOWING  THICKNESS
     , WIDTH, AND LENGTH."
230  PRINT : PRINT : PRINT : PRINT

250  PRINT  TAB( 5)"HOW MANY INCH
     ES THICK IS THE BOARD";: INPUT
     T
251  REM
252  REM CONVERT INCHES THICK
253  REM TO FEET.
254  REM
255 T = T / 12
260  PRINT : PRINT : PRINT
270  PRINT  TAB( 5)"HOW MANY FEET

      WIDE IS IT";: INPUT W: PRINT
     : PRINT : PRINT
280  PRINT  TAB( 5)"HOW MANY FEET
      LONG IS THE BOARD";: INPUT
     L: PRINT : PRINT : PRINT
290 B = T * W * L
291  REM
292  REM COVERT CUBED FEET TO
293  REM CUBED CENTIMETERS.
294  REM
295 C = B * 30.48
300  PRINT  TAB( 5)"THE VOLUME OF
      ONE BOARD IS ";C
310  PRINT " CUBED CENTIMETERS."

]
```

MANAGEMENT

This group of programs deals with Management and fi[illegible]es.

The first program is a program to figure the current value of a Treasury Bill. Treasury Bill's are bought and sold at a discount from their face value, prior to reaching maturity, and dicounts are figured as if a year were 360 days.

This program will read the face value of the bill, the date it was issued, when it matures, todays date, and the price bid for today. Then it will ouput the current value of the bill.

While running this program you must enter dates as month followed by a comma, day followed by a comma, and year followed by a comma.

An example of a run of this program would be if you had a bill with a face value of $15,000, that was issued on 3,5,83; and it maturies on 1,1,84. Say todays date is 11,5,83; and the price bid is 14%. If you enter these values at the proper time while running the program it would output the current value of the bill.

Here is a sample run and listing of the program.

```
]RUN TREASURY BILL



    THIS IS A PROGRAM TO FIND THE
CURRENT VALUE OF A TRESURY BILL.
         DEMONSTRATION PROGRAM
        FOR EDUCATIONAL USE ONLY



    PRESS <RETURN> TO CONTINUE?




    ENTER THE FACE VALUE (IN DALLORS)?15000

WHEN WAS IT ISSEUED:
    EX. 10,28,82
         MONTH ?3
         DAY   ?5
         YEAR  ?83

WHEN WILL IT MATURE:
         MONTH ?1
         DAY   ?1
         YEAR  ?84

WHAT IS TODAY'S DATE:
         MONTH ?11
         DAY   ?5
         YEAR  ?83

WHAT IS THE CURRENT PRICE BID (IN       PERCENT)?14



    THE BILL'S CURRENT VALUE IS $14667.5

    DO YOU WANT TO DO ANOTHER (Y/N)?
]LIST

9  HOME : PRINT : PRINT : PRINT
10  PRINT  TAB( 5)"THIS IS A PROG
     RAM TO FIND THE "
20  PRINT "CURRENT VALUE OF A TRE
     SURY BILL."
22  VTAB 10
23  INVERSE
24  HTAB 10: PRINT "DEMONSTRATION
      PROGRAM"
25  HTAB 9: PRINT "FOR EDUCATIONA
     L USE ONLY"
26  NORMAL
27  PRINT : PRINT : PRINT
28  PRINT  TAB( 5)"PRESS <RETURN>
      TO CONTINUE";: INPUT A$
```

```
30  HOME : PRINT : PRINT : PRINT

40  DEF  FN R(X) =  INT (X * 100 +
     .5) / 100
50  PRINT
60  PRINT  TAB( 5)"ENTER THE FACE
      VALUE (IN DALLORS)";
70  INPUT P
80  PRINT
90  PRINT "WHEN WAS IT ISSEUED:"
95  PRINT  TAB( 5)"EX. 10,28,82"
100  PRINT  TAB( 10)"MONTH ";: INPUT
     M
105  IF M < 0 OR M > 12 THEN  PRINT
     "REENTER": GOTO 100
110  PRINT  TAB( 10)"DAY   ";: INPUT
     D
115  IF D < 0 OR D > 31 THEN  PRINT
     "REENTER": GOTO 110
120  PRINT  TAB( 10)"YEAR  ";: INPUT
     Y
125  IF Y < 0 OR Y > 99 THEN  PRINT
     "REENTER": GOTO 120
130  PRINT
140  GOSUB 550
150  REM X3 IS THE ABSOLUTE # OF

160  REM DAYS FROM THE IMAGINARY

170  REM DATE 0-0-0 TO THE
180  REM ISSUE DATE.
190 X3 = A4
200  PRINT "WHEN WILL IT MATURE:"

210  PRINT  TAB( 10)"MONTH ";: INPUT
     M
215  IF M < 0 OR M > 12 THEN  PRINT
     "REENTER": GOTO 210
220  PRINT  TAB( 10)"DAY   ";: INPUT
     D
225  IF D < 0 OR D > 31 THEN  PRINT
     "REENTER": GOTO 220
230  PRINT  TAB( 10)"YEAR  ";: INPUT
     Y
235  IF Y < 0 OR Y > 99 THEN  PRINT
     "REENTER": GOTO 230
240  PRINT
250  GOSUB 550
260  REM X3 IS THE TOTAL # OF
270  REM DAYS IN THE PERIOD
280 X4 =  ABS (X3 - A4)
290  PRINT "WHAT IS TODAY'S DATE:
     "
300  PRINT  TAB( 10)"MONTH ";: INPUT
     M
305  IF M < 0 OR M > 12 THEN  PRINT
     "REENTER": GOTO 300
310  PRINT  TAB( 10)"DAY   ";: INPUT
     D
```

```
315  IF D < 0 OR D > 31 THEN  PRINT
     "REENTER": GOTO 310
320  PRINT  TAB( 10)"YEAR  ";: INPUT
     Y
325  IF Y < 0 OR Y > 99 THEN  PRINT
     "REENTER": GOTO 320
330  PRINT
340  GOSUB 550
350  REM X3 IS THE # OF DAYS FROM

360  REM ISSUE TO TODAY
370 X3 =  ABS (X3 - A4)
380  PRINT "WHAT IS THE CURRENT P
     RICE BID (IN        PERCENT)"
     ;
390  INPUT B
400  REM X4 IS THE # OF DAYS LEFT

410  REM LEFT UNTIL MATURITY
420 X4 = X4 - X3
430  PRINT : PRINT : PRINT
440  REM CV IS THE CURRENT
450  REM VALUE OF THE BILL
460 CV =  FN R(P - ((P / 1E4) * (
     B * (X4 / 360) * 100)))
470  PRINT  TAB( 5)"THE BILL'S CU
     RRENT VALUE IS $";CV
480  PRINT
490  PRINT  TAB( 5)"DO YOU WANT T
     O DO ANOTHER (Y/N)?";
500  GET A$
510  IF A$ = "Y" THEN  HOME : PRINT
     : PRINT : PRINT : GOTO 50
520  IF A$ = "N" GOTO 680
530  PRINT : PRINT : PRINT "ILLEG
                 AL ENTRY, TRY AG
     AIN.": PRINT : PRINT : PRINT

540  GOTO 480
550  REM SUBROUTINE TO DETERMINE
560  REM THE # OF DAYS BETWEEN
570  REM DATE 0-0-0 AND M-D-Y
580  REM USING 365/366 DAY YEAR.
590  REM
600  RESTORE
610  DATA   0,3,3,6,8,11,13,16,19
     ,             21,24,26
620  FOR I1 = 1 TO M
630  READ A4
640  NEXT I1
650 A4 = A4 + Y * 365 +  INT (Y /
     4) + 1 + (M - 1) * 28 + D
660  IF  INT (Y / 4) = Y / 4 AND
     M < 3 THEN A4 = A4 - 1
670  RETURN
680  END

]
```

The second program is "INTEREST ON BONDS". This program will calculates accrued interest to date on bonds. It will allow you to use either a 360 or a 365/366 day year. sometimes a bond is issued after the first period has begun a this results in a first coupon payment of less than the normal amount. Some isseues skip that payment and include it with the second. if this is the case press Y when the program ask coupon involves a long first period, and enter the additional dates.

dates should be entered as month comma, followed by day comma, followed by year <RETURN>.

An example problem to solve with this program would be; what is the accrued interest on 11,17,82 of a 12.09% bond due on 12,10,84 and isseued 11,05,80, with a long first period, and 2 coupons per year. The coupon dates are 6,10 and 12,10. The first period began on 12,10,80.

Here is a sample run of the program to solve this problem, followed by a listing of the program.

```
RUN INTEREST ON BONDS


    THIS IS A PROGRAM TO FIGURE THE
ACCURED INTEREST ON A BOND.
         DEMONSTRATION PROGRAM
        FOR EDUCATIONAL USE ONLY



    PRESS <RETURN> TO CONTINUE?



    DO YOU WANT TO USE:
              1 = 360 DAY YEAR
              2 = 365/266 DAY YEAR



WHAT IS THE COUPON RATE, IN PERCENT?12.06



    HOW MANY COUPONS ARE THERE,
EACH YEAR?2



    DOES THIS COUPON INCLUDE A LONG
FIRST PERIOD (Y/N)?



    WHEN IS THE BEGINNING OF THE FIRST
PERIOD. GIVE THE MONTH, DAY, AND YEAR.
    EX.  9,27,80
         MONTH    ?12
         DAY      ?10
         YEAR     ?80



    WHEN WAS THE BOND ISSUED
         MONTH    ?11
         DAY      ?5
         YEAR     ?80



    WHEN IS THE FIRST COUPON DATE
         MONTH    ?6
         DAY      ?10
         YEAR     ?81



    WHEN WILL THE CURRENT PERIOD END
```

```
          MONTH   ?12
          DAY     ?10
          YEAR    ?82


     WHEN IS THE SETTLEMENT DATE
          MONTH   ?12
          DAY     ?10
          YEAR    ?84






     THE ACCRUED INTEREST IS 12.5601071% OF PAR.



     DO YOU WANT TO RUN THIS PROGRAM
AGAIN (Y/N)?

]LIST

10  HOME : PRINT : PRINT : PRINT

20  PRINT  TAB( 5)"THIS IS A PROG
     RAM TO FIGURE THE"
30  PRINT "ACCURED INTEREST ON A
     BOND."
40  VTAB 10
50  INVERSE
60  HTAB 10: PRINT "DEMONSTRATION
      PROGRAM"
70  HTAB 7: PRINT "FOR EDUCATIONA
     L USE ONLY"
80  NORMAL
90  PRINT : PRINT : PRINT :
100  PRINT  TAB( 5)"PRESS <RETURN
     > TO CONTINUE";: INPUT A$
110  HOME : PRINT : PRINT : PRINT

120  PRINT  TAB( 5)"DO YOU WANT T
     O USE:"
130  PRINT  TAB( 15)"1 = 360 DAY
     YEAR"
140  PRINT  TAB( 15)"2 = 365/266
     DAY YEAR"
145  PRINT : PRINT : PRINT
150  GET X
160  IF X <  > 1 AND X <  > 2 THEN
      PRINT  TAB( 5)"ILLEGAL ENTR
     Y, TRY AGAIN.": PRINT : PRINT
     : PRINT : GOTO 120
170  PRINT "WHAT IS THE COUPON RA
     TE, IN PERCENT";: INPUT R
180  PRINT : PRINT : PRINT
190  PRINT  TAB( 5)"HOW MANY COUP
```

```
     ONS ARE THERE,"
195  PRINT "EACH YEAR";: INPUT NC

200 I1 = 0
210  PRINT : PRINT : PRINT
220  PRINT  TAB( 5)"DOES THIS COU
     PON INCLUDE A LONG"
230  PRINT "FIRST PERIOD (Y/N)?";
     : GET A$: PRINT
240  PRINT : PRINT : PRINT
250  IF A$ = "N" GOTO 400
260  IF A$ <  > "Y" THEN  PRINT  TAB(
     5)"ILLEGAL ENTRY, TRY AGAIN.
     ": PRINT : PRINT : PRINT : GOTO
     220
270  REM LONG FIRST PERIOD
280  PRINT  TAB( 5)"WHEN IS THE B
     EGINNING OF THE FIRST"
290  PRINT "PERIOD. GIVE THE MONT
     H, DAY, AND YEAR."
292  PRINT  TAB( 5)"EX.  9,27,80"

294  GOSUB 1000
300 I2 = J
310  REM ENTER ISSUE DATE
320  PRINT  TAB( 5)"WHEN WAS THE
     BOND ISSUED"
330  GOSUB 1000
340 I1 =  ABS (I2 - J)
350  PRINT  TAB( 5)"WHEN IS THE F
     IRST COUPON DATE"
360  GOSUB 1000
365  REM I2-DAYS IN FIRST PERIOD
370 I2 =  ABS (I2 - J)
380 I1 = (I2 - I1) / I2
390  GOTO 420
400  PRINT  TAB( 5)"WHEN WAS THE
     BEGINNING OF THE CURRENT"
410  PRINT "PERIOD": GOSUB 1000
420 I3 = J
430  PRINT  TAB( 5)"WHEN WILL THE
      CURRENT PERIOD END"
440  GOSUB 1000
450  REM I4-DAYS IN CURRENT PER
460 I4 =  ABS (I3 - J)
470  PRINT  TAB( 5)"WHEN IS THE S
     ETTLEMENT DATE"
480  GOSUB 1000
490 I3 =  ABS (I3 - J)
500 I3 = (I3 / I4) + I1
505 I = (R / NC) * I3
510  HOME : PRINT : PRINT : PRINT

520  PRINT  TAB( 5)"THE ACCRUED I
     NTEREST IS ";I;"% OF PAR."
530  PRINT : PRINT : PRINT
540  PRINT  TAB( 5)"DO YOU WANT T
     O RUN THIS PROGRAM"
550  PRINT "AGAIN (Y/N)?";: GET A
```

```
    $: PRINT
560  IF A$ = "Y" GOTO 120
570  END
1000  PRINT  TAB( 10)"MONTH    ";:
      INPUT M
1010  PRINT  TAB( 10)"DAY      ";:
      INPUT D
1020  PRINT  TAB( 10)"YEAR     ";:
      INPUT Y
1025  PRINT : PRINT : PRINT
1030  IF X = 1 THEN 1150
1040  REM FIND THE # OF DAYS
1045  REM FROM 0,0,0 TO M,D,Y
1046  REM USING A 365/366 DAY
1047  REM YEAR.
1050  RESTORE
1060  DATA  0,3,3,6,8,11,13,16,19
     ,21,24,26
1070  FOR Z = 1 TO M
1080  READ J
1090  NEXT Z
1100 J = J + Y * 365 +  INT (Y /
     4) + 1 + (M - 1) * 28 + D
1110  IF  INT (Y / 4) <  > Y / 4 OR
     M > 2 THEN  RETURN
1120 J = J - 1
1130  RETURN
1140  REM USING A 360 DAY YEAR
1150 J = (Y * 360) + (M * 360) +
     D
1160  RETURN

]
```

The next program is "CONTINUOUS INTEREST COMPOUND". This program calculates the future value of an investment with interest compounded continuosly.

An example problem to solve with this program would be if you invested $2,000 at 7.75% interest what will you have earned in 2 years. Here is a sample run to solve this problem, and a listing of the program.

```
RUN CONTINUOUS INTEREST COMPOUND



    THIS IS A PROGRM TO FIGURE
CONTINUOUS INTEREST COMPOUNDING.
         DEMONSTRATION PROGRAM
        FOR EDUCATIONAL USE ONLY



    PRESS <RETUEN> TO CONTINUE?






    WHAT IS THE ANNUAL RATE OF INTEREST
TO BE PAID ON THE ACCOUNT?7.75



    HOW MANY YEARS WILL INTEREST
ACCRUE, (ENTER FRACTIONS OF YEARS IN
DECIMAL FORM  EXAMPLE 5.75)?2



    WHAT WAS YOUR INITIAL DEPOSIT?2000



    CONTINUOUSLY COMPOUNDING AT A RATE
OF 7.75%, OVER 2 YEARS, A DEPOSIT
OF $2000 WILL GROW TO $2335.32

]LIST

10  HOME : PRINT : PRINT : PRINT

80  PRINT  TAB( 5)"THIS IS A PROG
     RM TO FIGURE"
90  PRINT "CONTINUOUS INTEREST CO
     MPOUNDING."
92  VTAB 10
93  INVERSE
```

```
94  HTAB 10: PRINT "DEMONSTRATION
      PROGRAM"
95  HTAB (9): PRINT "FOR EDUCATIO
     NAL USE ONLY"
96  NORMAL : PRINT : PRINT : PRINT
     : PRINT  TAB( 5)"PRESS <RETU
     EN> TO CONTINUE";: INPUT A$
97  HOME : PRINT : PRINT : PRINT

100  HOME : PRINT : PRINT : PRINT

110  PRINT  TAB( 5)"WHAT IS THE A
     NNUAL RATE OF INTEREST"
120  PRINT "TO BE PAID ON THE ACC
     OUNT";
130  INPUT I
140  IF 1 <  = 0 THEN 110
150  PRINT : PRINT : PRINT
160  PRINT  TAB( 5)"HOW MANY YEAR
     S WILL INTEREST"
170  PRINT "ACCRUE, (ENTER FRACTI
     ONS OF YEARS IN"
180  PRINT "DECIMAL FORM  EXAMPLE
      5.75)";
190  INPUT N
200  IF N <  = 0 THEN 150
210  PRINT : PRINT : PRINT
220  PRINT  TAB( 5)"WHAT WAS YOUR
      INITIAL DEPOSIT";
230  INPUT D
240  IF D <  = 0 THEN 220
250  HOME : PRINT : PRINT : PRINT

260  PRINT  TAB( 5)"CONTINUOUSLY
     COMPOUNDING AT A RATE"
270  PRINT "OF ";I:"%. OVER ";N;"
      YEARS, A DEPOSIT"
280  PRINT "OF $";D;" WILL GROW T
     O $"; INT (100 * (D *  EXP (
     I / 100 * N)) + .5) / 100
290  END

]
```

The next program is "TAX DEDUCTION". This program computes the amount of savings you might realize by deducting interest payments.

An example problem for this program would be if there was a tax rate of 50%, and an interest rate of 14.05%, with projected interest payments of $4,000, $5,000, $6,000, and $4,500 over the next 4 years what would be the present value of the tax savings. Here is a sample run of the program to solve this problem, and a listing of the program.

```
RUN TAX DEDUCTION
    THIS IS A PROGRAM TO FIGURE THE
PRESENT VALUE OF AN INTEREST TAX
DEDUCATION.
         DEMONSTRATION PROGRAM
        FOR EDUCATIONAL USE ONLY



    PRESS <RETURN> TO CONTINUE?



    WHAT IS THE TAX RATE, IN PERCENT?50

    WHAT IS THE INTEREST RATE, IN       PERCENT?14.05

    HOW MANY PERIODS ARE THERE?4

    WHAT IS THE INTEREST AMOUNT FOR
 PERIOD 1 $?4000
          PERIOD 2 $?5000
          PERIOD 3 $?6000
          PERIOD 4 $?4500


THE PRESENT VALUE OF THE DEDUCTION IS:
         $7027.7

    DO YOU WANT TO RUN THE PROGRAM
AGAIN (Y/N)?
]LIST

1  HOME
10  PRINT  TAB( 5)"THIS IS A PROG
      RAM TO FIGURE THE"
15  PRINT "PRESENT VALUE OF AN IN
     TEREST TAX"
20  PRINT "DEDUCATION."
22  VTAB 10
23  INVERSE
24  HTAB 10: PRINT "DEMONSTRATION
      PROGRAM"
```

```
25  HTAB 9: PRINT "FOR EDUCATIONA
     L USE ONLY"
26  NORMAL
27  PRINT : PRINT : PRINT
28  PRINT  TAB( 5)"PRESS <RETURN>
      TO CONTINUE";: INPUT A$
29  HOME : PRINT : PRINT : PRINT

30  PRINT  TAB( 5)"WHAT IS THE TA
     X RATE, IN PERCENT";
40  INPUT T
50 T = T / 100
55  PRINT
60  PRINT  TAB( 5)"WHAT IS THE IN
     TEREST RATE, IN        PERCEN
     T";
70  INPUT K
80 K = K / 100
85  PRINT
90  PRINT  TAB( 5)"HOW MANY PERIO
     DS ARE THERE";
100  INPUT N
105  PRINT
110 P = 0
120  FOR J = 1 TO N
130  IF J > 1 THEN 160
140  PRINT  TAB( 5)"WHAT IS THE I
     NTEREST AMOUNT FOR"
150  GOTO 170
160  HTAB 10
170  PRINT " PERIOD ";J;" $";
180  INPUT Z
190 P = P + (Z * T) / ((1 + K) ^
     J)
200  NEXT J
210  HOME : PRINT : PRINT : PRINT

220  PRINT "THE PRESENT VALUE OF
     THE DEDUCTION IS:"
225  HTAB 10: PRINT "$"; INT (P *
     100 + .5) / 100
230  PRINT
240  PRINT  TAB( 5)"DO YOU WANT T
     O RUN THE PROGRAM"
245  PRINT "AGAIN (Y/N)?";
250  GET Z$
260  IF Z$ = "Y" THEN 20
270  IF Z$ <  > "N" THEN 240
280  END

]
```

The next program is "PRESENT VALUE OF INVESTMENT". This program will calculate the present value of all cash flows associated with an investment including the initial investment.

A sample problem for this program would be if you had an investment of $6,000 and you wanted a 15% interest return off the investement, but you got $10 per month over the next 2 years. If the program returns a positve number then your investment is good, if not you should reject it.

Here is a sample run to solve this problem and a listing of the program.

```
]RUN PRESENT VALUE OF INVESTMENT


    THIS IS A PROGRAM TO COMPUTE
THE PRESENT VALUE OF AN INVESTMENT.
         DEMONSTRATION PROGRAM
        FOR EDUCATIONAL USE ONLY



    PRESS <RETURN> TO CONTINUE?




    ENTER THE AMOUNT INVESTED?6000
THE NUMBER OF YEARS IT HAS BEEN INVESTED?2
    WHAT PERCENT RATE OF RETURN DO YOU
WANT?15

ENTER CASH FLOW AMOUNTS EACH YEAR
(ENTER OVERFLOWS AS NEGATIVE).

INFLOW FOR YEAR 1 ?120
                2 ?120

NET PRESENT VALUE = $ -5804.91

    DO YOU WANT TO RUN THIS PROGRAM
AGAIN (Y/N)?
]LIST

5  HOME : PRINT : PRINT : PRINT
10  PRINT  TAB( 5)"THIS IS A PROG
     RAM TO COMPUTE"
15  PRINT "THE PRESENT VALUE OF A
     N INVESTMENT."
16  VTAB 10
17  INVERSE
18  HTAB 10: PRINT "DEMONSTRATION
      PROGRAM"
19  HTAB 9: PRINT "FOR EDUCATIONA
     L USE ONLY"
20  NORMAL
21  PRINT : PRINT : PRINT
22  PRINT  TAB( 5)"PRESS <RETURN>
      TO CONTINUE";: INPUT A$
23  HOME : PRINT : PRINT : PRINT

29  DEF  FN A(X) =  INT (X * 100 +
     .5) / 100
30  REM ADD DIM C(N) STATEMENT
35  REM AT LINE 40
36  REM IF MAXIMUM NUMBER OF CASH

37  REM FLOWS IS > 10
40  REM
```

```
50  PRINT
60  PRINT  TAB( 5)"ENTER THE AMOU
     NT INVESTED";
70  INPUT CO
80 CO =  -  FN A(CO)
90  PRINT "THE NUMBER OF YEARS IT
      HAS BEEN INVESTED";
100  INPUT N
110  PRINT  TAB( 5)"WHAT PERCENT
     RATE OF RETURN DO YOU"
120  PRINT "WANT";: INPUT R
130 R = R / 100 + 1
140 F = 0
150  PRINT
160  PRINT "ENTER CASH FLOW AMOUN
     TS EACH YEAR"
170  PRINT "(ENTER OVERFLOWS AS N
     EGATIVE)."
175  PRINT
180  FOR J = 1 TO N
190  IF J > 1 THEN 220
200  PRINT "INFLOW FOR YEAR ";
210  GOTO 230
220  PRINT "                 ";
230  PRINT J;" ";
240  INPUT C(J)
260  NEXT J
270 T = CO
280  REM ADD PRESENT VALUES FOR
281  REM EACH YEAR BASED ON RATE
282  REM OF R
290  FOR J = 1 TO N
300 T = T +  FN A(C(J) / (R ^ J))

310  NEXT J
320  PRINT
330  PRINT "NET PRESENT VALUE = $
      "; FN A(T)
340  REM  RESTART END OF PROGRAM
350  PRINT
360  PRINT  TAB( 5)"DO YOU WANT T
     O RUN THIS PROGRAM"
365  PRINT "AGAIN (Y/N)?";
370  GET A$
375  HOME
380  IF A$ = "Y" GOTO 50
390  IF A$ = "N" THEN 400
395 : PRINT : PRINT : PRINT  TAB(
     5)"ILLEGAL ENTRY, TRY AGAIN.
     ": PRINT : PRINT :
396  GOTO 360
400  END

]
```

The next program is "FUTURE VALUE OF INVESTMENT". This program will compute the number of all cash flows to and from an investment.

A sample problem would be if you were going to invest $500 in a chicken ranch which would return 14% interest per-quater, but you had to by $2 of feed per month, would over a period of two years would you come out ahead. You must enter the initial investment, the $500. the number of cash flows counting this investment would be 25, but only the 500 will be positive, since you did not increase your investment.

Here is a run of the program to solve this problem, and a program listing.

```
RUN FUTURE VALUE OF INVESTMENT



    THIS IS A PROGRAM TO FIGURE THE
FUTURE VALUE OF AN INVESTMENT.
         DEMONSTRATION PROGRAM
        FOR EDUCATIONAL USE ONLY



    PRESS <RETURN> TO CONTINUE?



    HOW MANY CASH FLOWS ARE THERE?25

WHAT IS THE GROWTH RATE. IN PERCENT?14

(ENTER INFLOWS AS POSITIVE,
 OUTFLOWS AS NEGATIVE)
AMOUNT OF CASH FLOW 1 ?500
                    2 ?-2
                    3 ?-2
                    4 ?-2
                    5 ?-2
                    6 ?-2
                    7 ?-2
                    8 ?-2
                    9 ?-2
                    10 ?-2
                    11 ?-2
                    12 ?-2
                    13 ?-2
                    14 ?-2
                    15 ?-2
                    16 ?-2
                    17 ?-2
                    18 ?-2
                    19 ?-2
                    20 ?-2
                    21 ?-2
                    22 ?-2
                    23 ?-2
                    24 ?-2
                    25 ?-2

    THE FUTURE VALUE AT THE END OF 25
PERIODS WILL BE $11288.8

    DO YOU WANT TO RUN THE PROGRAM
AGAIN (Y/N)?
]LIST

5  HOME : PRINT : PRINT : PRINT
10  PRINT  TAB( 5)"THIS IS A PROG
     RAM TO FIGURE THE"
15  PRINT "FUTURE VALUE OF AN INV
```

```
    ESTMENT."
16  VTAB 10: INVERSE
17  HTAB 10: PRINT "DEMONSTRATION
     PROGRAM"
18  HTAB 9: PRINT "FOR EDUCATIONA
    L USE ONLY"
19  NORMAL : PRINT : PRINT : PRINT

20  PRINT  TAB( 5)"PRESS <RETURN>
     TO CONTINUE";: INPUT A$
22  HOME : PRINT : PRINT : PRINT

29  DEF  FN A(X) =  INT (X * 100 +
    .5) / 100
30  PRINT
40  PRINT  TAB( 5)"HOW MANY CASH
    FLOWS ARE THERE";
50  INPUT N
55  PRINT
60  PRINT "WHAT IS THE GROWTH RAT
    E, IN PERCENT";
70  INPUT R
80 R = R / 100
90  PRINT
100 T = 0
110  PRINT "(ENTER INFLOWS AS POS
     ITIVE,"
115  PRINT " OUTFLOWS AS NEGATIVE
     )"
120  FOR J = 1 TO N
130  IF J > 1 THEN 160
140  PRINT "AMOUNT OF CASH FLOW "
     ;
150  GOTO 170
160  HTAB 21
170  PRINT J;" ";
180  INPUT C
190  REM ADD FUTURE VALUE OF EACH

192  REM YEAR BASED ON RATE OF R
200 T = T +  FN A(C * (1 + R) ^ (
    N - J))
210  NEXT J
220  PRINT
230  PRINT  TAB( 5)"THE FUTURE VA
     LUE AT THE END OF ";N
235  PRINT "PERIODS WILL BE $";T
240  REM RESTART OF END PROGRAM?
250  PRINT
260  PRINT  TAB( 5)"DO YOU WANT T
     O RUN THE PROGRAM"
265  PRINT "AGAIN (Y/N)?";
270  GET Z$
280  IF Z$ = "Y" THEN 30
290  IF Z$ = "N" THEN 300
295  PRINT : PRINT : PRINT "ILLEG
     AL ENTRY, TRY AGAIN.": PRINT
     : PRINT : PRINT
300  END
```

The next program is "DEPRECIATION SWITCH". This program to determine when to switch from an accelerated depreciation to a straight line depreciation in order to obtain the largest possible amount of depreciation in both the earlier and later years.

A sample problem for this program would be if you buy an item that has a useful life of 7 years, and you plan to use 200% declining balance depreciation. If you are into the 3rd month of the first year, when should you switch to stright line depreciation in order to maximise the depreciation.

Here is a sample run to solve that problem, and a listing of the program.

```
]RUN DEPRECIATION SWITCH


    THIS IS A PROGRAM TO COMPUTE
DEPRECIATION.
         DEMONSTRATION PROGRAM
        FOR EDUCATIONAL USE ONLY



    PRESS <RETURN> TO CONTINUE?




WHAT PERCENT ACCELERATED DEPRECIATION
DO YOU WANT TO USE?200



    WHAT IS THE USEFUL LIFE OF THE
ASSET IN YEARS?7



    HOW MANY MONTHS ARE LEFT IN
THE FIRST YEAR?9




    YOU SHOULD SWITCH IN THE 5TH YEAR.

    DO YOU WANT TO DO ANOTHER (Y/N)?

]LIST

5  HOME : PRINT : PRINT : PRINT
10  PRINT  TAB( 5)"THIS IS A PROG
     RAM TO COMPUTE"
15  PRINT "DEPRECIATION."
16  VTAB 10
17  INVERSE
18  HTAB 10: PRINT "DEMONSTRATION
      PROGRAM"
19  HTAB 9: PRINT "FOR EDUCATIONA
     L USE ONLY"
20  NORMAL
21  PRINT : PRINT : PRINT
22  PRINT  TAB( 5)"PRESS <RETURN>
      TO CONTINUE";: INPUT A$
```

```
23  HOME : PRINT : PRINT : PRINT

29  REM USE MILLON DOLLAR COST
30  REM TO SEPARATE CLOSE
35  REM CALCULATIONS.
40 C = 1E + 6
50  REM RESET AUMULATION
55  REM DEPRECIATION TO ZERO.
60 A = 0
70  PRINT
80  PRINT "WHAT PERCENT ACCELERAT
     ED DEPRECIATION"
85  PRINT "DO YOU WANT TO USE";
90  INPUT T
100  PRINT : PRINT : PRINT
110 T = T / 100
120  PRINT  TAB( 5)"WHAT IS THE U
     SEFUL LIFE OF THE"
125  PRINT "ASSET IN YEARS";
130  INPUT L
135  PRINT : PRINT : PRINT
140  IF L > 3 THEN 170
150  PRINT  TAB( 5)"3 YEARS MIN.
     TRY AGAIN."
160  PRINT : PRINT : PRINT : GOTO
     120
170  PRINT  TAB( 5)"HOW MANY MONT
     HS ARE LEFT IN"
175  PRINT "THE FIRST YEAR";
180  INPUT M
185  PRINT : PRINT : PRINT
190 Y = 1
200  REM CALCULATE DEPRECIATION
201  REM ACCUMULATED IN THE 1ST
202  REM YEAR.
210 A =  INT (((M / 12) * (T / L)
      * C) * 100 + .5) / 100
220 Y = Y + 1
230  REM COMPUTE AMOUNT OF
231  REM DEPRECIATION THIS YEAR.
240 D =  INT (((T / L) * (C - A))
      * 100 + .5) / 100
250  REM IF DEPRECIATION IS
251  REM LESS THAN VALUE
252  REM DIVIDED BY REMAINING
253  REM LIFE, PRINT YEAR NUMBER.

270  IF D < (C - A) / (L - Y + 1 +
     (12 - M) / 12) THEN 310
280  REM IF NOT INCREMENT
281  REM ACCUMULATED DEPRECIATION
     .
290 A = A + D
```

```
300  GOTO 220
310  PRINT
320  PRINT  TAB( 5)"YOU SHOULD SW
     ITCH IN THE ";Y;"TH YEAR."
330  PRINT
340  PRINT  TAB( 5)"DO YOU WANT T
     O DO ANOTHER (Y/N)?";: GET A
     $: PRINT
350  IF A$ = "Y" THEN  PRINT : PRINT
     : PRINT : GOTO 60
360  END

]
```

The next program is "INTERNAL RATE OF RETURN". This program finds the rate at which all cash flows discount to the amount of the initial investment. to use this program enter the amount of the initial investment, the term of the investment, and the cash flows. For example, say you have an investment of $5,000 with returns of $600, $800, $1,200, and $600 over the next four terms. enter this to the program. The program will output the % of return on your loan over the four terms.

Here is a sample run and listing of the program.

```
RUN INTERNAL RATE OF RETURN



    THIS IS A PROGRAM TO FIGURE THE
INTERNAL RATE OF RETURN ON AN
INVESTMENT. IT WILL KEEP RUNNING UNTILL
0 IS INPUT AS THE INITIAL INVESTMENT.
         DEMONSTRATION PROGRAM
        FOR EDUCATIONAL USE ONLY



    PRESS <RETURN> TO CONTINUE?



    WHAT IS YOUR INITIAL INVESTMENT $?50000

    HOW MANY CASH FLOWS ARE THERE?4

(ENTER INFLOWS AS POSITIVE,
 OUTFLOWS AS NEGATIVE)
CASH FLOW 1 ?600
          2 ?800
          3 ?1200
          4 ?600


YOUR INTERNAL RATE OF RETURN IS 50%.

    DO YOU WANT TO DO ANOTHER (Y/N)?

]LIST

5  HOME : PRINT : PRINT : PRINT
10  PRINT  TAB( 5)"THIS IS A PROG
     RAM TO FIGURE THE"
15  PRINT "INTERNAL RATE OF RETUR
     N ON AN"
16  PRINT "INVESTMENT. IT WILL KE
     EP RUNNING UNTILL"
17  PRINT "0 IS INPUT AS THE INIT
     IAL INVESTMENT."
20  REM FUNCTION TO ROUND
21  REM TO NEAREST HUNDERTH.
30  DEF  FN A(X) =  INT (X * 100 +
     .5) / 100
40  REM FUNCTION TO ROUND TO
41  REM NEAREST TEN-THOUSANDTH.
50  DEF  FN B(X) =  INT (X * 1E4 +
     .5) / 1E4
60  REM CHANGE SIZE OF ARRAY
61  REM C() IF NECESSARY.
70  DIM C(12)
71  VTAB 10
72  INVERSE
73  HTAB 10: PRINT "DEMONSTRATION
      PROGRAM"
```

```
74  HTAB 9: PRINT "FOR EDUCATIONA
     L USE ONLY"
75  NORMAL
76  PRINT : PRINT : PRINT
77  PRINT  TAB( 5)"PRESS <RETURN>
      TO CONTINUE";: INPUT A$
78  HOME : PRINT : PRINT : PRINT

90  PRINT  TAB( 5)"WHAT IS YOUR I
     NITIAL INVESTMENT $";
100  INPUT I
110  REM  END PROGRAM
120  IF I = 0 THEN 590
130  PRINT
140  PRINT  TAB( 5)"HOW MANY CASH
      FLOWS ARE THERE";
150  INPUT N
160  REM  RESTART IF # OF CASH
161  REM FLOW PERIODS IS INVALID.

170  IF N < 1 THEN 80
180  REM LOOP INPUT AND SUM
181  REM CASH FLOW AMOUNTS.
190 F = 0
200  PRINT
210  PRINT "(ENTER INFLOWS AS POS
     ITIVE,
215  PRINT " OUTFLOWS AS NEGATIVE
     )
220  FOR J = 1 TO N
230  IF J > 1 THEN 260
240  PRINT "CASH FLOW ";
250  GOTO 270
260  HTAB 11
270  PRINT J;" ";
280  INPUT C(J)
300  NEXT J
310  PRINT
320  REM INITIALIZE VALUES
330 L = 0
340 H = 1
350 R1 = 0
360  REM GUESS RATE=(HIGH
361  REM RATE+LOW RATE)/2
370 R = (L + H) / 2
380  REM EXIT IF RATE REMAINS
381  REM UNCHANGED.
390  IF R = R1 THEN 550
400  REM SET LAST GUESS TO
401  REM TO CURRENT GUESS.
410 R1 = R
420  REM ADD PRESENT VALUES
421  REM FOR EACH YEAR BASED
422  REM RATE OF.
430 T = 0
440  FOR J = 1 TO N
450 T = T +  FN A(C(J) / ((R + 1)
      ^ J))
460  NEXT J
```

```
470  REM IF TOTAL PRESENT
471  REM VALUES EQUAL INVESTMENT.

472  REM EXIT.
480  IF T = I THEN 550
490  REM SET HIGH OF LOW
491  REM RATE TOCURRENT GUESS.
500  IF I > T THEN 530
510 L = R
520  GOTO 370
530 H = R
550  PRINT
560  PRINT "YOUR INTERNAL RATE OF
      RETURN IS " FN B(R * 100);"
     %."
570  PRINT
580  PRINT  TAB( 5)"DO YOU WANT T
     O DO ANOTHER (Y/N)?";
590  GET A$: PRINT
600  IF A$ = "Y" THEN  HOME : PRINT
     : PRINT : PRINT : GOTO 90

]
```

The next program is "MORTGAGE AMORTIZATION". This program will calculate and output a loan repayment schedule. For instance, suppose you make a loan with a friend of $700.00 at 9% interest. Further suppose you plan to pay your friend back over the next eight months at $100 a month. This program will print you a repayment schedule given this information.

Here is a sample run and listing of the program.

```
RUN MORTGAGE AMORTIZATION
      MORTGAGE AMORTIZATION TABLE



    THIS PROGRAN WILL PRINTOUT
A MORTGAGE AMORTIZATION TABLE.
       DEMONSTRATION PROGRAM
      FOR EDUCATIONAL USE ONLY



    PRESS <RETURN> TO CONTINUE?
    WHAT WILL THE PAYMENTS BE?100
    HOW IS THE TERM IN YEARS & MONTHS
         YEARS   ?0
         MONTHS  ?8
    WHAT IS THE PRINCIPLE?700
    WHAT IS THE ANNUAL INTEREST RATE,
IN PERCENT?9
    HOW MANY PAYMENTS PER YEAR?12
    WHAT YEAR DO YOU WANT TO START
THE CHART FROM?1
PRINCIPAL $700 AT 9 %
FOR 0 YEARS & 8 MONTHS
WITH REGULAR PAYMENTS OF $100
NO.  INTEREST AMORTIZED BALANCE ACCUM.IN
1    5.25     94.75     605.25  5.25
2    4.54     95.46     509.79  9.79
3    3.82     96.18     413.61  13.61
4    3.1      96.9      316.71  16.71
5    2.38     97.62     219.09  19.09
6    1.64     98.36     120.73  20.73
7    .91      99.09     21.64   21.64
8    .16      21.64     0       21.8

***LAST PAYMENT = $21.8

YR 1 21.8     700

RECOMPUTE WITH NEW DATA (Y/N)N

]LIST

1  REM DEFINE ROUND OFF
2  REM FUNCTION.
5  DEF  FN R(X) =  INT (X * 100 +
     .5) / 100
6  TEXT : HOME : PRINT  TAB( 7)"M
     ORTGAGE AMORTIZATION TABLE"
7  REM SET TEXT WINDOW
8  REM TO LINES 2 TO 24
9  POKE 34,1: PRINT
```

```
10  PRINT : PRINT : PRINT  TAB( 5
     )"THIS PROGRAN WILL PRINTOUT
     "
11  PRINT "A MORTGAGE AMORTIZATIO
     N TABLE."
12  VTAB 10
13  INVERSE
14  HTAB 10: PRINT "DEMONSTRATION
      PROGRAM"
15  HTAB 9: PRINT "FOR EDUCATIONA
     L USE ONLY"
16  NORMAL
17  PRINT : PRINT : PRINT
18  PRINT  TAB( 5)"PRESS <RETURN>
      TO CONTINUE";: INPUT A$
19  HOME
22  REM STATEMENTS 30 TO
23  REM 140 REQUIRE USER INPUT.
30  PRINT  TAB( 5)"WHAT WILL THE
     PAYMENTS BE";: INPUT R
40  PRINT  TAB( 5)"HOW IS THE TER
     M IN YEARS & MONTHS"
45  HTAB 10: PRINT "YEARS    ";: INPUT
     YO
50  HTAB 10: PRINT "MONTHS   ";: INPUT
     M
64  REM CALCULATE YEARS FROM
65  REM YEARS AND MONTHS.
66 Y = (12 * YO + M) / 12
70  PRINT  TAB( 5)"WHAT IS THE PR
     INCIPLE";: INPUT P
80  PRINT  TAB( 5)"WHAT IS THE AN
     NUAL INTEREST RATE,"
90  PRINT "IN PERCENT";: INPUT I
105  REM CONVERT FROM PERCENT
106  REM TO DECIMAL.
110 I = I / 100
120  PRINT  TAB( 5)"HOW MANY PAYM
     ENTS PER YEAR";: INPUT N
140  PRINT  TAB( 5)"WHAT YEAR DO
     YOU WANT TO START"
150  PRINT "THE CHART FROM";: INPUT
     X
155  REM START PRINTING AT
156  REM BEGINNING OF YEAR.
160 X =  INT (X)
165  REM INITIALIZE VARIABLES.
170 C1 = 0
180 I2 = 0
190 I3 = 0
200 J0 = 0
210 N1 = N
220 B0 = P
```

```
230 A1 = 0
240 A2 = 0
255  REM PRINT INFORMATION
256  REM THAT DOSENT CHANGE
257  REM ON THE SCREEN.
260  HOME : PRINT "PRINCIPAL $";P
     ;" AT ";I * 100;" %"
270  PRINT "FOR ";YO;" YEARS & ";
     M;" MONTHS"
280  PRINT "WITH REGULAR PAYMENTS
      OF $";R
290  VTAB 5: PRINT "NO.";: HTAB 6
     : PRINT "INTEREST";: HTAB 15
     : PRINT "AMORTIZED";: HTAB 2
     5: PRINT "BALANCE";: HTAB 33
     : PRINT "ACCUM.IN"
295  REM SET TEXT WINDOW TO
296  REM LINES 6 TO 24
300  POKE 34,5: HOME
309  REM SET LINE COUNTER.
310 CT = 6
315  REM TERMS LESS THAN 1 YR?
320  IF  INT (Y) >  = 1 THEN 360
325  REM ADJUST VARIABLE TO
326  REM PRINT A PARTIAL YEAR.
330 N1 = ((Y -  INT (Y)) * 12) /
     12 * N
340 JO = JO + 1: GOTO 410
359  REM LOOPFOR EACH YEAR.
360  FOR JO = 1 TO  INT (Y)
410  FOR J1 = 1 TO N1
415  REM CALCULATE INTEREST PAID
416  REM THIS PAYMENT, ROUND OFF
420 I1 =  INT ((BO * I / N) * 100
      + .5) / 100
425  REM COUNT # OF PAYMENTS
426  REM MADE SO FAR.
430 C1 = C1 + 1
435  REM CALCULATE AMOUNT
436  REM AMORTIZED THIS
437  REM PAYMENT.
440 A = R - I1
445  REM SUM AMOUNT AMORTIZED
446  REM TO DATE.
450 A1 = A1 + A
455  REM CALCULATE BALANCE DUE.
460 BO = P - A1
465  REM LAST PAYMENT? IF YES
466  REM CALCULATE AMOUNT SO
467  REM THAT THE BALANCE
468  REM DUE=0.00 AFTER THIS
469  REM PAYMENT.
470  IF C1 <  > N * Y THEN 520
```

```
480 R = R + BO
490 A = A + BO
500 A1 = A1 + BO
510 BO = 0
515  REM SUM INTEREST PAID
516  REM TO DATE.
520 I2 = I2 + I1
525  REM SUM INTEREST PAID
526  REM THIS YEAR.
530 I3 = I3 + I1
535  REM SUM AMOUNT AMORTIZED
536  REM THIS YEAR.
540 A2 = A2 + A
545 A2 =  INT (A2 * 100 + .5) / 1
     00
546  REM STARTED PRINTING?
547  REM IF YES, PRINT COMPUTED
548  REM VALUES IN TABLE.
550  IF JO < X THEN 570
555  REM ROUND OFF THEN PRINT.
560  PRINT J1;: HTAB 6: PRINT  FN
     R(I1);: HTAB 15: PRINT  FN R
     (A);: HTAB 25: PRINT  FN R(B
     O);: HTAB 33: PRINT  FN R(I2
     ):CT = CT + 1: GOSUB 800
570  NEXT J1
575  REM LAST PAYMENT? IF YES
576  REM ROUND OFF & PRINT.
580  IF C1 <  > N * Y THEN 600
590  PRINT : PRINT "***LAST PAYME
     NT = $";( INT (R * 100 + .5)
     ) / 100
595  REM STARTED PRINTING?
596  REM IF YES, PRINT
597  REM YEARLY TOTALS.
600  IF JO < X THEN 640
615  REM ROUND OFF AND PRINT.
620  PRINT : PRINT "YR ";JO;: HTAB
     6: PRINT  FN R(I3);: HTAB 15
     : PRINT  FN R(A2)
625  PRINT :CT = CT + 2: GOSUB 80
     0
626  REM COMPLETED TEST?
640  IF JO > Y THEN 730
645  REM REINITIALIZE YEARLY
646  REM VARIABLES.
650 I3 = 0
660 A2 = 0
670  NEXT JO
671 JO = JO - 1
675  REM NEED TO PRINT A
676  REM PARTIAL YEAR.
680  IF Y <  > JO THEN 330
```

```
729  REM RESTART OR END PROGRAM
730  VTAB 23: INPUT "RECOMPUTE WI
     TH NEW DATA (Y/N)";Z$
735  TEXT : POKE 34,1
740  IF Z$ = "Y" GOTO 19
750  TEXT : END
795  REM PAUSE AND WAIT FOR
796  REM USER RESPONSE?
800  IF CT < 20 THEN  RETURN
810  VTAB 23: INPUT "PRESS <RETUR
     N> TO CONTINUE ";Z$: HOME :C
     T = 6: RETURN

]
```

The next program is "PRODUCTION AND DISTRUBUTION". This program will tell you the best possible combinations of producers with distributors with regard to transportation cost.

For axample, say you have three shops each rebuilding engines. and you have 2 distributors that sale and install the engines. the first shop can build 5 engines per week, the second can build 3 and the third only 2. now the first distributor can sale and install 6 engines per week, and the second can sale and install 5. Suppose it cost $40 to take one engine from shop 1 to distributor 1, and $60 to go from shop 1 to distributor 2. While it only requires $30 dallors to go from shop 2 to dist. 2, but $90 to go from shop 2 to dist. 1. It takes $45 to go from shop 3 to dist. 1 and $40 to go from shop 3 to dist 2. If you enter these values into the program it will tell you the cheepest combinations of shops to dist.

Here is a sample run and listing of the program.

```
RUN PRODUCTION AND DISTRUBUTION



    THIS IS A PROGRAM TO GIVE THE BEST
POSSIBLE COMBINATION OF PRODUCERS TO
DISTRIBUTORS.
         DEMONSTRATION PROGRAM
        FOR EDUCATIONAL USE ONLY



    PRESS <RETURN> TO CONTINUE?



HOW MANY PRODUCERS ARE THERE?3
HOW MANY DISTRIBUTORS?2
CAPABILITY OF PRODUCER 1 ?5
CAPABILITY OF PRODUCER 2 ?3
CAPABILITY OF PRODUCER 3 ?2
OUTPUT FROM DISTRIBUTOR 1 ?6
OUTPUT FROM DISTRIBUTOR 2 ?5
TRANSPORTATION COST:
FROM PRODUCER 1 TO DISTRIBUTOR 1 ?40
FROM PRODUCER 1 TO DISTRIBUTOR 2 ?60
FROM PRODUCER 2 TO DISTRIBUTOR 1 ?90
FROM PRODUCER 2 TO DISTRIBUTOR 2 ?30
FROM PRODUCER 3 TO DISTRIBUTOR 1 ?45
FROM PRODUCER 3 TO DISTRIBUTOR 2 ?40

PRODUCER DIST. # ITEMS COST TOTAL
1        1     5        40   200
2        2     3        30   90
3        1     1        45   45
3        2     1        40   40

TOTAL COST OF SOLUTION: 375


    DO YOU WANT TO RUN THIS PROGRAM
AGAIN (Y/N)?

]LIST

5  HOME : PRINT : PRINT : PRINT
10  REM PRODUCTION AND DISTRIBUTI
     ON
20  DIM P(10,2),D(10,2),P1(20,2),
     C(10,10)
30  DIM A(10,10),Y(19,2),M(3),R1(
     10),K1(10)
40  PRINT  TAB( 5)"THIS IS A PROG
     RAM TO GIVE THE BEST"
42  PRINT "POSSIBLE COMBINATION O
     F PRODUCERS TO"
44  PRINT "DISTRIBUTORS."
45  VTAB 10
46  INVERSE
```

```
47  HTAB 10: PRINT "DEMONSTRATION
      PROGRAM"
48  HTAB 9: PRINT "FOR EDUCATIONA
     L USE ONLY"
50  NORMAL
51  PRINT : PRINT : PRINT
52  PRINT  TAB( 5)"PRESS <RETURN>
      TO CONTINUE";: INPUT A$
59  HOME : PRINT : PRINT : PRINT

60  PRINT "HOW MANY PRODUCERS ARE
      THERE";
70  INPUT P2
80  IF P2 < 1 THEN 60
90  PRINT "HOW MANY DISTRIBUTORS"
     ;
100  INPUT D1
110  IF D1 < 1 THEN 90
120  REM ENTER PRODUCTION
125  REM CAPABILITY OF PRODUCER
130 T1 = 0
140  FOR I = 1 TO P2
150  PRINT "CAPABILITY OF PRODUCE
     R ";I;" ";
160  INPUT P(I,1)
170 P(I,2) = P(I,1)
180 T1 = T1 + P(I,1)
190  NEXT I
200 T2 = 0
210  REM ENTER TURNOVER FROM
211  REM EACH DISTRIBUTOR.
220  FOR I = 1 TO D1
230  PRINT "OUTPUT FROM DISTRIBUT
     OR ";I;" ";
240  INPUT D(I,1)
250 D(I,2) = D(I,1)
260 T2 = T2 + D(I,1)
270  NEXT I
280  REM  LOOP TO READ
285  REM TRANSPORTATION COST
290  PRINT "TRANSPORTATION COST:
     "
300  FOR I = 1 TO P2
310  REM  INITIALIZE P1() ARRAY
320 P1(I,1) = 0
330 P1(I,2) = 0
340  FOR K = 1 TO D1
345 A(I,K) = 0
350  PRINT "FROM PRODUCER ";I;" T
     O DISTRIBUTOR ";K;" ";
360  INPUT C(I,K)
370  IF C(I,K) < 0 THEN 350
380  NEXT K
390  NEXT I
400  REM THE MATRIX HAS BEEN
401  REM ENTERED
405  REM START FIRST SOLUTION
406  REM PHASE
410 P0 = 0
```

```
420 DO = 0
430  IF T1 >  = T2 THEN 480
440  REM SUPPLY =DEMAND AND:
441  REM SET UP DUMMY ROWS
442  REM AND COLUMS
450 P(P2 + 1,1) = T2 - T1
460 P(P2 + 1,2) = T2 - T1
470 PO = 1
475  GOTO 510
480  IF T2 = T1 THEN 510
490 D(D1 + 1,1) = T1 - T2
500 D(D1 + 1,2) = T1 - T2
505 DO = 1
510 D2 = 0
520 T3 = 0
530  REM START SOLUTION WITH
531  REM NORTHWEST CORNER RULE
540  FOR R = 1 TO P2 + PO
550  REM IF SUPPLY AT ROW
551  REM R EXHAUSTED, MOVE
552  REM TO NEXT SOURCE
560  IF P(R,2) = 0 THEN 770
570  REM ALLOCATE SUPLLY TO
571  REM DEMAND
580  FOR K = 1 TO D1 + DO
590  REM IF DISTRIBUTOR K
591  REM FILLED, INCREMENT
592  REM COLUM INDEX
600  IF D(K,2) = 0 THEN 760
610  IF P(R,2) = 0 THEN 760
620  IF P(R,2) < D(K,2) THEN 690
630  REM SET UP STONE SQUARE
631  REM IF DEMAND<=SUPPLY
640 A(R,K) = D(K,2)
650 P(R,2) = P(R,2) - D(K,2)
660 D(K,2) = 0
670  GOTO 720
680  REM SET UP STONE SQUARE
681  REM IF DEMAND>SUPPLY
690 A(R,K) = P(R,2)
700 D(K,2) = D(K,2) - P(R,2)
710 P(R,2) = 0
720 D2 = D2 + 1
730 T3 = T3 + (A(R,K) * C(R,K))
740 P1(D2,1) = R
750 P1(D2,2) = K
760  NEXT K
770  NEXT R
780  REM CHECK SOLUTION FOR
781  REM FIRST STAGE
782  REM DEGENERACY
790  IF D2 = P2 + PO + D1 + DO -
     1 THEN 1140
800  REM SOLVE DEGENERATE
801  REM SOLUTION
810 R = 0
820 K = 0
830 I = 0
840 I = I + 1
```

```
850  IF A(P1(I,1),P1(I,2)) = D(P1
     (I,2),1) THEN 870
860  IF A(P1(I,1),P1(I,2)) < > P
     (P1(I,1),1) THEN 900
870 R = P1(I,1) + 1
880 K = P1(I,2)
890  GOTO 1030
900  IF I < D2 + D0 THEN 840
910  REM IF R & K EQUAL ZERO,
911  REM THE MATRIX IS NOT
912  REM DEGENERATED
920  IF R + K = 0 THEN 1140
930  IF P1(I - 1,2) = K THEN 960
940 K = P1(I - 1,2)
950  GOTO 1000
960  IF K = D2 + D0 THEN 990
970 K = K + 1
980  GOTO 1000
990 K = K - 1
1000  REM INSERT A NEW STONE
1001  REM SQUARE IN THE
1002  REM SOLUTION
1010  IF K > P1(I,2) THEN 1030
1020 I = I - 1
1030  FOR J = D2 + 1 TO I + 1 STEP
      - 1
1040 P1(J,1) = P1(J - 1,1)
1050 P1(J,2) = P1(J - 1,2)
1055 M0 = J
1060  NEXT J
1070 P1(M0,1) = R
1080 P1(M0,2) = K
1090 Y(I,1) = 0
1100 Y(I,2) = 0
1110 D2 = D2 + 1
1120  GOTO 790
1130  REM CALCULATE REM VALUES
1140  FOR I = 1 TO D1 + D0
1150 K1(I) =  - 9E4
1160  NEXT I
1170  FOR I = 1 TO P2 + P0
1180 R1(I) =  - 9E4
1190  NEXT I
1200 R1(P1(1,1)) = 0
1210 K1(P1(1,2)) = C(P1(1,1).P1(1
      ,2))
1220 R = 1
1230 K = 1
1240 I = 1
1250 I = I + 1
1260  IF K1(P1(I,2)) < > - 9E4 THEN
      1300
1270  IF R1(P1(I,1)) =  - 9E4 THEN
      1330
1280 K1(P1(I,2)) = C(P1(I,1).P1(I
      ,2)) - R1(P1(I,1))
1290 K = K + 1
1300  IF R1(P1(I,1)) < > - 9E4 THEN
      1330
```

```
1310 R1(P1(I,1)) = C(P1(I,1),P1(I
    ,2)) - K1(P1(I,2))
1320 R = R + 1
1330  IF I < D2 THEN 1250
1340  IF K < D1 + DO THEN 1240
1350  IF R < P2 + PO THEN 1240
1360 I = 1
1370 M(1) = 0
1380  REM FIND AN ELEMENT WITH
1381  REM THE LOWEST INDEX
1390  FOR R = 1 TO P2 + PO
1400  FOR K = 1 TO D1 + DO
1410  IF R <  > P1(I,1) THEN 1450

1420  IF K <  > P1(I,2) THEN 1450

1430 I = I + 1
1440  GOTO 1490
1450  IF M(1) < C(R,K) - R1(R) -
    K1(K) THEN 1490
1460 M(1) = C(R,K) - R1(R) - K1(K
    )
1470 M(2) = R
1480 M(3) = K
1490  NEXT K
1500  NEXT R
1510  IF M(1) >  = 0 THEN 2790
1520  REM FIND A CLOSED PATH
1521  REM R, COL. K
1530 Y(1,1) = M(2)
1540 Y(1,2) = M(3)
1550 Q = 1
1560  IF M(2) = P2 + PO THEN 1960

1570  REM  MO=CURRENT ROW TO
1571  REM SEACH ON;
1575  REM M1=START COLUM TO
1576  REM SEARCH ON
1580 MO = Y(Q,1)
1590 M1 = 1
1600  REM START ROW SEARCH
1610 I = 0
1620 I = I + 1
1630  IF P1(I,1) > MO THEN 1670
1640  IF P1(I,1) < MO THEN 1660
1650  IF P1(I,2) >  = M1 THEN 172
    0
1660  IF I < D2 THEN 1620
1670  IF Q <  > 1 THEN 1700
1680  PRINT "MATRIX IS DEGENERATE
    D"
1690  GOTO 2410
1700  REM AT THIS POINT,
1701  REM NO ROW NEIGHBORS
1702  REM EXIT
1710  GOTO 1830
1720  REM MAKE SURE V(I) IS
1721  REM NOT ALREADY ON THE
1722  REM CLOSED PATH
```

```
1730 XO = 0
1740  FOR J = 1 TO Q
1750  IF P1(I,1) <  > Y(J,1) THEN
    1780
1760  IF P1(I,2) <  > Y(J,2) THEN
    1780
1770 XO = 1
1780  NEXT J
1790  IF XO = 0 THEN 1890
1800 M1 = P1(I,1) + 1
1810  IF M1 <  = D1 + D0 THEN 166
    0
1820  REM ROW SEARCH FAILED:
1825  REM SET NEXT COORDINANTS
1826  REM FOR COLUM SEARCH
1830 S = Y(Q,2)
1840 S1 = Y(Q,1) + 1
1850 Y(Q,1) = 0
1860 Y(Q,2) = 0
1870 Q = Q - 1
1880  GOTO 2000
1890 Q = Q + 1
1900 Y(Q,1) = P1(I,1)
1910 Y(Q,2) = P1(I,2)
1920  IF Q <  = 2 THEN 1950
1930  REM IF PATH CLOSES
1931  REM ON A ROW SEARCH
1932  REM THEN EXIT SEARCH
1933  REM ROUTINE.
1940  IF Y(Q,2) = M(3) THEN 2340
1950 M1 = Y(Q,2) + 1
1960  REM COLUM SEARCH AREA
1970  REM P=COLUN # TO SEARCH
1980 S = Y(Q,2)
1990 S1 = 1
2000 K = 0
2010 K = K + 1
2020  IF P1(K,1) < S1 THEN 2040
2030  IF P1(K,2) = S THEN 2120
2040  IF K < D2 THEN 2010
2050  REM COLUM SEARCH FAILURE;
2055  REM SET NEW COORDINANTS
2056  REM FOR ROW SEARCH
2060 M0 = Y(Q,1)
2070 M1 = Y(Q,2) + 1
2080 Y(Q,1) = 0
2090 Y(Q,2) = 0
2100 Q = Q - 1
2110  GOTO 1610
2120 XO = 0
2130  REM LOOKUP ROUTINE
2135  REM CHECK FOR USED
2136  REM STONE SQUARE
2140  FOR J = 1 TO Q
2150  IF P1(K,1) <  > Y(J,1) THEN
    2180
2160  IF P1(K,2) <  > Y(J,2) THEN
    2180
2170 XO = 1
```

```
2180  NEXT J
2190  IF XO = 0 THEN 2250
2200 S1 = P1(K,1) + 1
2210  IF S1 <  = P2 + PO THEN 204
     0
2220  GOTO 2050
2230  REM A UNIQUE STONE
2231  REM SQUARE WAS FOUND
2232  REM ADDIT TO THE
2233  REM CLOSED PATH ARRAY
2250 Q = Q + 1
2260 Y(Q,1) = P1(K,1)
2270 Y(Q,2) = P1(K,2)
2280  REM IF PATH CLOSES ON COLUM

2281  REM SEARCH, EXIT SEARCH
2282  REM ROUTINE
2290  IF Y(Q,1) = M(2) THEN 2340
2300 S1 = Y(Q,1) + 1
2310 MO = Y(Q,1)
2320 M1 = Y(Q,2) + 1
2330  GOTO 1610
2340  REM FIND LOWEST-ALLOCATION
2341  REM STONE SQUARE ON CLODSED

2342  REM PATH
2350 XO = A(Y(2,1),Y(2,2))
2360  FOR K = 4 TO Q STEP 2
2370  IF XO <  = A(Y(K,1),Y(K,2))
      THEN 2390
2380 XO = A(Y(K,1),Y(K,2))
2390  NEXT K
2400  REM ALTERNATELY ADD &
2401  REM SUBTRACT XO
2410 S = 0
2420  FOR K = 1 TO Q
2430 KO = K / 2
2435  IF KO =  INT (KO) THEN 2460

2440 A(Y(K,1),Y(K,2)) = A(Y(K,1),
     Y(K,2)) + XO
2450  GOTO 2630
2460 A(Y(K,1),Y(K,2)) = A(Y(K,1),
     Y(K,2)) - XO
2470  IF A(Y(K,1),Y(K,2)) > 0 THEN
     2630
2480  REM DELETE ANY SQUARES
2481  REM WITH A ZERO ALLOCATION
2490 I = 0
2500 S = S + 1
2510  REM  IF S>1 MATRIX WILL
2511  REM BE DEGENERATE
2520  IF S > 1 THEN 2630
2530 I = I + 1
2540  IF P1(I,1) <  > Y(K,1) THEN
     2530
2550  IF P1(I,2) <  > Y(K,2) THEN
     2530
2560  FOR J = I TO D2
```

```
2570 P1(J,1) = P1(J + 1,1)
2580 P1(J,2) = P1(J + 1,2)
2590  NEXT J
2600 P1(D2,1) = 0
2610 P1(D2,2) = 0
2620 D2 = D2 - 1
2630  NEXT K
2640  REM INSERT NEW STONE
2641  REM SQUARE FROM FIRST
2642  REM OF Y()
2650 I = 0
2660 I = I + 1
2665  IF I > D2 THEN 2700
2670  IF Y(1,1) > P1(I,1) THEN 26
    60
2680  IF Y(1,1) < P1(I,1) THEN 27
    00
2690  IF Y(1,2) > P1(I,2) THEN 26
    60
2700  FOR J = D2 TO I STEP  - 1
2710 P1(J + 1,1) = P1(J,1)
2720 P1(J + 1,2) = P1(J,2)
2730  NEXT J
2740 P1(I,1) = Y(1,1)
2750 P1(I,2) = Y(1,2)
2760 D2 = D2 + 1
2770  REM END OF REALOCATION
2775  REM REITERATE MODI CHECK
2780  GOTO 1140
2790  REM DISPLAY RESULTS AND
2791  REM COST OF SOLUTION
2800  PRINT
2810  IF D0 + P0 = 0 THEN 2870
2820  PRINT "*** UNBALANCED SOLUT
    ION ***"
2830  IF D0 = 0 THEN 2850
2840  PRINT "EXCESS SUPPLY (";D(D
    1 + D0,1);")"
2845  PRINT "ASSIGNED TO DISTRIBU
    TOR ";D1 + D0
2850  IF P0 = 0 THEN 2870
2860  PRINT "EXCESS DEMAND (";P(P
    2 + P0,1);")"
2865  PRINT "ASSIGNED TO PRODUCER
     ";P2 + P0
2870 X0 = 0
2875  PRINT "PRODUCER DIST. # ITE
    MS COST TOTAL"
2880  FOR I = 1 TO D2
2900  PRINT P1(I,1); TAB( 10);P1(
    I,2); TAB( 16);A(P1(I,1),P1(
    I,2));
2905  PRINT  TAB( 24);C(P1(I,1),P
    1(I,2)); TAB( 29)
2910 J = C(P1(I,1),P1(I,2)) * A(P
    1(I,1),P1(I,2))
2920  IF J > 0 THEN 2950
2930  PRINT "DUMMY"
2940  GOTO 2970
```

```
2950 XO = XO + J
2960  PRINT J
2970  NEXT I
2980  PRINT
2990  PRINT "TOTAL COST OF SOLUTI
     ON: ";XO
3000  PRINT
3010  PRINT
3020  PRINT  TAB( 5)"DO YOU WANT
     TO RUN THIS PROGRAM"
3030  PRINT "AGAIN (Y/N)?";
3040  GET XO$: PRINT
3050  IF XO$ = "Y" THEN 59
3055  IF XO$ = "N" THEN 3060
3056  PRINT : PRINT : PRINT "ILLE
     GAL ENTRY, TRY AGAIN.": PRINT
     : PRINT : PRINT
3057  GOTO 3020
3060  END

]
```

The next program is "CHECKBOOK RECONCILIATION". This program will help you reconzile your checkbook with your bank statement.

For example, say your bank statement says you have $300 in your account. Also it does not show a $100 deposit you made last thursday, or two checks one for $20 and one for $40 that you've written since. You would enter to the program 300 for your ending balance, 100 for the deposits not shown, and 20 and 40 for checks not shown. Then the program will report your account balance. Next the program will ask for your checkbook balance and service charges if there are any. finally the program will report your ajusted account balance. if this does not = your account balance you have some type of error, or the bank does.

Here is a sample run and listing of the program.

```
RUN CHECKBOOK RECONCILIATION



    THIS IS A PROGRAM TO RECONZILE
YOUR CHECK BOOK WITH YOUR BANK STATEMENT.
         DEMONSTRATION PROGRAM
        FOR EDUCATIONAL USE ONLY




    PRESS <RETURN> TO CONTINUE?



    WHAT IS YOUR BANK STATEMENT'S ENDING
BALANCE $?300




    HOW MANY DEPOSITS ARE NOT SHOWN
BY THE STATEMENT?1
WHAT WAS THE AMOUNT OF
                       DEPOSIT 1 $?100




    HOW MANY OUTSTANDING CHECKS
ARE THERE?2




HOW MUCH WAS
             CHECK 1 $?20
             CHECK 2 $?40

YOUR ACCOUNT BALANCE IS $340

    WHAT IS YOUR CHECKBOOK BALANCE?343.30
    WHAT WHERE THE SERVICE CHARGES?3.30

YOUR ADJUSTED ACCOUNT BALANCE IS $340

    DO YOU WANT TO RUN THIS PROGRAM
AGAIN, (Y/N)?
]LIST

5  HOME : PRINT : PRINT : PRINT
10  PRINT  TAB( 5)"THIS IS A PROG
     RAM TO RECONZILE"
15  PRINT "YOUR CHECK BOOK WITH Y
     OUR BANK STATEMENT."
20  REM FUNCTION TO DETERMINE IF
21  REM POSITIVE DOLLAR AMOUNT
22  REM WAS ENTERED.
30  DEF  FN B(X) =  INT (X * 100 +
     .5) / 100 *  SGN (X)
40  VTAB 10
41  INVERSE
```

```
42  HTAB 10: PRINT "DEMONSTRATION
      PROGRAM"
43  HTAB 9: PRINT "FOR EDUCATIONA
     L USE ONLY"
44  NORMAL
45  PRINT : PRINT : PRINT
46  PRINT  TAB( 5)"PRESS <RETURN>
      TO CONTINUE";: INPUT A$
47  HOME : PRINT : PRINT : PRINT

50  PRINT  TAB( 5)"WHAT IS YOUR B
     ANK STATEMENT'S ENDING"
55  PRINT "BALANCE $";
60  INPUT E
70  REM SPECIAL TEST FOR
71  REM VALID INPUT
75  REM (NEGATIVE # ALLOWED)
77 X = E * 100
80  IF X =  INT (X) THEN 120
90  REM VALID AMOUNT DISPLAY
91  REM ERROR, LOOP TO
95  REM REENTER.
100  GOSUB 680
110  GOTO 50
120  PRINT : PRINT : PRINT
125  PRINT  TAB( 5)"HOW MANY DEPO
     SITS ARE NOT SHOWN"
126  PRINT "BY THE STATEMENT";: INPUT
     I1
127  IF I1 = 0 GOTO 260
128  PRINT "WHAT WAS THE AMOUNT O
     F"
129 D = 0
130  FOR I2 = 1 TO I1
140  HTAB 24: PRINT "DEPOSIT ";I2
     ;" $";
160  INPUT A
170  REM ALL DEPOSITS ENTERED.
190  REM  NO, TEST FOR VALID
195  REM ENTRY.
200  IF ( FN B(A) = A) THEN 240
210  REM  INVALID, PRINT
211  REM STANDARD ERROR,
212  REM LOOP TO RE-ENTER.
220  GOSUB 720
230  GOTO 160
240 D = D + A
250  NEXT I2
260  PRINT : PRINT : PRINT
261  PRINT  TAB( 5)"HOW MANY OUTS
     TANDING CHECKS"
262  PRINT "ARE THERE";: INPUT I1

263  PRINT : PRINT : PRINT
264  IF I1 = 0 GOTO 400
265  PRINT "HOW MUCH WAS"
266 C = 0
270  FOR I2 = 1 TO I1
275  HTAB 14: PRINT "CHECK ";I2;"
```

```
      $";
300  INPUT A
330  REM NO,TEST FOR VALID
331  REM ENTRY.
340  IF ( FN B(A) = A) THEN 380
350  REM INVALID, PRINT
351  REM STANDARD ERROR LOOP
352  REM TO RE-ENTER.
360  GOSUB 720
370  GOTO 300
380 C = C + A
390  NEXT I2
400  PRINT
405 Y =  INT ((E + D - C) * 100 +
     .5) / 100
410  PRINT "YOUR ACCOUNT BALANCE
     IS $";Y
420  PRINT
430  PRINT  TAB( 5)"WHAT IS YOUR
     CHECKBOOK BALANCE";
440  INPUT B
450  PRINT  TAB( 5)"WHAT WHERE TH
     E SERVICE CHARGES";
460  INPUT S
470  REM TEST FOR VALID ENTRY.
480  IF  FN B(S) = S THEN 520
490 IN VAL ID, PRINT ERR OR
495  REM LOOP
500  GOSUB 720
510  GOTO 450
520  PRINT
525 X =  INT ((B - S) * 100 + .5)
      / 100
530  PRINT "YOUR ADJUSTED ACCOUNT
      BALANCE IS $";X
540  IF Y = X THEN 620
550  PRINT
560  PRINT "YOUR ACCOUNT IS OUT O
     F BALANCE"
570  PRINT "MAKE SURE YOU HAVE IN
     CLUDED"
575  PRINT "ALL TRANSACTIONS AGAI
     NST THIS ACCOUNT"
580  PRINT "INCLUDING AUTOMATIC D
     EPOSITS AND"
590  PRINT "INTEREST PAYMENTS AS
     WELL AS"
595  PRINT "PRE-AUTORIZED WITHDRA
     WALS."
600  PRINT
610  REM
620  PRINT
630  PRINT  TAB( 5)"DO YOU WANT T
     O RUN THIS PROGRAM"
635  PRINT "AGAIN. (Y/N)?";
640  GET Z$
650  IF Z$ = "Y" GOTO 47
660  IF Z$ = "N" THEN 760
665  PRINT : PRINT : PRINT "ILLEG
```

```
     AL ENTRY, TRY AGAIN.": PRINT
     : PRINT : PRINT
670  GOTO 630
680  PRINT
690  PRINT "ERROR: ENTER A VALID
     DOLLAR AMOUNT ONLY"
700  PRINT
710  RETURN
720  PRINT
730  PRINT "ERROR: ENTER A POSITI
     VE"
740  PRINT "       DOLLAR AMOUNT
     ONLY"
745  PRINT
750  RETURN
760  END

]
```

GRAPHICS

This set of programs deals with Three-Dimensional Graphics. The first program of the group is "DEFINE OBJECT". This program defines an object in 3-D to be viewed by another program, called "VIEWS". The objects created by "DEFINE OBJECT" can be viewed by the program "VIEW OBJECT", but "VIEW OBJECT" does not remove hidden lines, nor does it center the object, or allow for parallel projections.

"DEFINE OBJECT" works on the basis of a three coordinant system. They are the X, Y, and Z-coordinants. To use this program you must have the object defined in this type of coordinant system.

To run this program you need to know the number of sides the object has, the number of corners it has, the coordinants of each corner, and what corners are in what sides. You must also be able to enter the corners that make up the sides in counterclockwise order as they appear while viewing the side from outside the object.

IMPORTANT NOTE FOR ALL GRAPHICS PROGRAMS: Somtimes when you turn on the graphics page it will delete part of your basic program. To avoid this run the program "ALLOCATE" which moves your basic program to a different location in memory, thus getting it out of the way of the graphics page. This will only be necessary for long graphics programs.

After "DEFINE OBJECT" has run it will ask you if you want to view the object. If you enter Y then "DEFINE OBJECT" will run the program "VIEW OBJECT".

Here then is a sample run and listing of "DEFINE OBJECT".

```
RUN   DEFINE OBJECT


    THIS PROGRAM LETS YOU DEFINE AN
OBJECT IN 3-D.
         DEMONSTRATION PROGRAM
        FOR EDUCATIONAL USE ONLY



    PRESS <RETURN> TO CONTINUE?



    TO RUN THIS PROGRAM YOU MUST KNOW
THE NUMBER OF SIDES AND THE NUMBER
OF CORNERS. YOU MUST ALSO BE ABLE TO
SAY WHICH CORNERS COMPRISE WHICH
SIDES.

    YOU WILL NEED TO BE ABLE TO GIVE
THE CORNERS IN COUNTERCLOCKWISE ORDER
AS THEY APPEAR WHEN OBSERVED FROM
FROM OUTSIDE THE OBJECT.


    DO YOU HAVE THIS INFORMATION (Y/N)?


ENTER THE NUMBER OF SIDES?6
ENTER THE NUMBER OF CORNERS?8




ENTER THE X-COORDINANT OF CORNER 1 ?0
ENTER THE Y-COORDINANT OF CORNER 1 ?0
ENTER THE Z-COORDINANT OF CORNER 1 ?0

ENTER THE X-COORDINANT OF CORNER 2 ?4
ENTER THE Y-COORDINANT OF CORNER 2 ?0
ENTER THE Z-COORDINANT OF CORNER 2 ?0

ENTER THE X-COORDINANT OF CORNER 3 ?4
ENTER THE Y-COORDINANT OF CORNER 3 ?4
ENTER THE Z-COORDINANT OF CORNER 3 ?0

ENTER THE X-COORDINANT OF CORNER 4 ?0
ENTER THE Y-COORDINANT OF CORNER 4 ?4
ENTER THE Z-COORDINANT OF CORNER 4 ?0

ENTER THE X-COORDINANT OF CORNER 5 ?0
ENTER THE Y-COORDINANT OF CORNER 5 ?0
ENTER THE Z-COORDINANT OF CORNER 5 ?-4

ENTER THE X-COORDINANT OF CORNER 6 ?4
ENTER THE Y-COORDINANT OF CORNER 6 ?0
ENTER THE Z-COORDINANT OF CORNER 6 ?-4

ENTER THE X-COORDINANT OF CORNER 7 ?4
ENTER THE Y-COORDINANT OF CORNER 7 ?4
ENTER THE Z-COORDINANT OF CORNER 7 ?-4

ENTER THE X-COORDINANT OF CORNER 8 ?0
ENTER THE Y-COORDINANT OF CORNER 8 ?4
ENTER THE Z-COORDINANT OF CORNER 8 ?-4


HOW MANY CORNERS ARE IN SIDE 1 ?4


ENTER THE CORNERS OF SIDE 1.
BE SURE TO ENTER THE CORNERS IN
COUNTERCLOCKWISE ORDER, AS THEY APPEAR
WHILE VIEWING THE OBJECT FROM THE
OUTSIDE.


ENTER THE NUMBER OF CORNER 1 OF
SIDE 1 ?1
ENTER THE NUMBER OF CORNER 2 OF
SIDE 1 ?2
ENTER THE NUMBER OF CORNER 3 OF
SIDE 1 ?3
ENTER THE NUMBER OF CORNER 4 OF
SIDE 1 ?4

HOW MANY CORNERS ARE IN SIDE 2 ?4


ENTER THE CORNERS OF SIDE 2.
BE SURE TO ENTER THE CORNERS IN
COUNTERCLOCKWISE ORDER, AS THEY APPEAR
WHILE VIEWING THE OBJECT FROM THE
OUTSIDE.


ENTER THE NUMBER OF CORNER 1 OF
SIDE 2 ?8
ENTER THE NUMBER OF CORNER 2 OF
SIDE 2 ?7
ENTER THE NUMBER OF CORNER 3 OF
```

```
SIDE 2 ?6
ENTER THE NUMBER OF CORNER 4 OF
SIDE 2 ?5


HOW MANY CORNERS ARE IN SIDE 3 ?4



ENTER THE CORNERS OF SIDE 3.
BE SURE TO ENTER THE CORNERS IN
COUNTERCLOCKWISE ORDER, AS THEY APPEAR
WHILE VIEWING THE OBJECT FROM THE
OUTSIDE.


ENTER THE NUMBER OF CORNER 1 OF
SIDE 3 ?2
ENTER THE NUMBER OF CORNER 2 OF
SIDE 3 ?6
ENTER THE NUMBER OF CORNER 3 OF
SIDE 3 ?7
ENTER THE NUMBER OF CORNER 4 OF
SIDE 3 ?3


HOW MANY CORNERS ARE IN SIDE 4 ?4



ENTER THE CORNERS OF SIDE 4.
BE SURE TO ENTER THE CORNERS IN
COUNTERCLOCKWISE ORDER, AS THEY APPEAR
WHILE VIEWING THE OBJECT FROM THE
OUTSIDE.


ENTER THE NUMBER OF CORNER 1 OF
SIDE 4 ?5
ENTER THE NUMBER OF CORNER 2 OF
SIDE 4 ?1
ENTER THE NUMBER OF CORNER 3 OF
SIDE 4 ?4
ENTER THE NUMBER OF CORNER 4 OF
SIDE 4 ?8


HOW MANY CORNERS ARE IN SIDE 5 ?4



ENTER THE CORNERS OF SIDE 5.
BE SURE TO ENTER THE CORNERS IN
```

```
COUNTERCLOCKWISE ORDER, AS THEY APPEAR
WHILE VIEWING THE OBJECT FROM THE
OUTSIDE.


ENTER THE NUMBER OF CORNER 1 OF
SIDE 5 ?4
ENTER THE NUMBER OF CORNER 2 OF
SIDE 5 ?3
ENTER THE NUMBER OF CORNER 3 OF
SIDE 5 ?7
ENTER THE NUMBER OF CORNER 4 OF
SIDE 5 ?8


HOW MANY CORNERS ARE IN SIDE 6 ?4



ENTER THE CORNERS OF SIDE 6.
BE SURE TO ENTER THE CORNERS IN
COUNTERCLOCKWISE ORDER, AS THEY APPEAR
WHILE VIEWING THE OBJECT FROM THE
OUTSIDE.


ENTER THE NUMBER OF CORNER 1 OF
SIDE 6 ?5
ENTER THE NUMBER OF CORNER 2 OF
SIDE 6 ?6
ENTER THE NUMBER OF CORNER 3 OF
SIDE 6 ?2
ENTER THE NUMBER OF CORNER 4 OF
SIDE 6 ?1


WHAT FILE DO YOU WANT THE OBJECT
SAVED IN?CUBE



THIS PROGRAM WILL ALSO ALLOW YOU TO
VIEW THE OBJECT. DO YOU WANT TO VIEW
THE OBJECT (Y/N)?



]LIST

2  REM THIS IS A PROGRAM TO
4  REM DEFINE AN OBJECT IN
6  REM THREE DIMENSIONS.
8  REM
```

```
10  REM THIS PROGRAM WILL
12  REM HAVE THE USER
14  REM ENTER THE NUMBER OF
16  REM SIDES AND THEN
18  REM ENTER THE NUMBER
20  REM OF CORNERS. THEN
22  REM THE PROGRAM HAS THE
24  REM USER SPECIFY WHERE
26  REM THE CONERS ARE.
28  REM THE PROGRAM THEN
30  REM ASK WHAT CORNERS
32  REM ARE IN WHAT
34  REM SIDES. THE
36  REM PROGRAM STORES
38  REM SIDES AS EDGES
40  REM AND THE EDGES
42  REM ARE SAVED AS
44  REM CORNERS.
46  REM
48  REM THE DATA CREATED
50  REM BY THIS PROGRAM
52  REM IS STORED IN A FILE
54  REM TO BE VIEWED BY
56  REM THE PROGRAM "VIEWS".
58  REM
60  REM THIS PROGRAM ALSO ALLOWS
62  REM THE USER TO VIEW THE
64  REM OBJECT. BUT WITHOUT
66  REM THE HIDDEN-LINES
68  REM REMOVED.
70  REM
75  DIM V(40,3),E(40,2),S(10,10)
78  REM
79  HOME : PRINT : PRINT : PRINT

80  PRINT  TAB( 5)"THIS PROGRAM L
     ETS YOU DEFINE AN"
90  PRINT "OBJECT IN 3-D."
91  VTAB 10
92  INVERSE
93  HTAB 10: PRINT "DEMONSTRATION
      PROGRAM"
94  HTAB 9: PRINT "FOR EDUCATIONA
     L USE ONLY"
95  NORMAL
96  PRINT : PRINT : PRINT
97  PRINT  TAB( 5)"PRESS <RETURN>
      TO CONTINUE";: INPUT A$
98  HOME : PRINT : PRINT : PRINT

100  PRINT  TAB( 5)"TO RUN THIS P
     ROGRAM YOU MUST KNOW"
110  PRINT "THE NUMBER OF SIDES A
```

```
     ND THE NUMBER"
120  PRINT "OF CORNERS. YOU MUST
     ALSO BE ABLE TO"
130  PRINT "SAY WHICH CORNERS COM
     PRISE WHICH"
140  PRINT "SIDES."
150  PRINT
160  PRINT  TAB( 5)"YOU WILL NEED
      TO BE ABLE TO GIVE"
170  PRINT "THE CORNERS IN COUNTE
     RCLOCKWISE ORDER"
180  PRINT "AS THEY APPEAR WHEN O
     BSERVED FROM"
190  PRINT "FROM OUTSIDE THE OBJE
     CT.": PRINT : PRINT
200  PRINT  TAB( 5)"DO YOU HAVE T
     HIS INFORMATION (Y/N)?";
205  GET A$: PRINT : PRINT : PRINT

210  IF A$ = "N" GOTO 620
220  IF A$ = "Y" GOTO 240
230  PRINT  TAB( 5)"ILLEGAL ENTRY
     , TRY AGAIN.": PRINT : PRINT
     : PRINT : GOTO 200
240  PRINT "ENTER THE NUMBER OF S
     IDES";
250  INPUT NS
260  PRINT "ENTER THE NUMBER OF C
     ORNERS";
270  INPUT NV
275  PRINT : PRINT : PRINT
280  FOR I = 1 TO NV
290  PRINT "ENTER THE X-COORDINAN
     T OF CORNER ";I;" ";
300  INPUT V(I,1)
310  PRINT "ENTER THE Y-COORDINAN
     T OF CORNER ";I;" ";
320  INPUT V(I,2)
330  PRINT "ENTER THE Z-COORDINAN
     T OF CORNER ";I;" ";
340  INPUT V(1,3)
345  PRINT
350  NEXT I
355 K = 0
360  FOR I = 1 TO NS
370  PRINT : PRINT : PRINT "HOW M
     ANY CORNERS ARE IN SIDE ";I;
     " ";
380  INPUT SV
385  PRINT : PRINT : PRINT
390  PRINT "ENTER THE CORNERS OF
     SIDE ";I;"."
400  PRINT "BE SURE TO ENTER THE
```

```
    CORNERS IN"
410  PRINT "COUNTERCLOCKWISE ORDE
     R, AS THEY APPEAR"
420  PRINT "WHILE VIEWING THE OBJ
     ECT FROM THE"
430  PRINT "OUTSIDE.": PRINT . PRINT

440  FOR J = 1 TO SV
450  PRINT "ENTER THE NUMBER OF C
     ORNER ";J;" OF"
460  PRINT "SIDE ";I;" ";: INPUT
     Q
470 E(K + J,1) = Q
475 S(I,J) = K + J
480  IF J = 1 GOTO 500
490 E(K + J - 1,2) = Q
500  IF J <  > SV GOTO 520
510 E(K + J,2) = E(K + 1,1)
520  NEXT J
530 K = K + SV
535  NEXT I
536 D$ =  CHR$ (4)
541  PRINT : PRINT : PRINT "WHAT
     FILE DO YOU WANT THE OBJECT"
     : PRINT "SAVED IN";: INPUT N
     $: PRINT : PRINT : PRINT
542  PRINT D$;"OPEN";N$: PRINT D$
     ;"CLOSE";N$
543  PRINT D$;"DELETE";N$
544  PRINT D$;"OPEN";N$
545  PRINT D$;"WRITE";N$
546  FOR I = 1 TO 40: PRINT V(I,1
     ): PRINT V(I,2): PRINT V(I,3
     ): NEXT I
547  FOR I = 1 TO 40: PRINT E(I,1
     ): PRINT E(I,2): NEXT I
548  FOR I = 1 TO 10: FOR J = 1 TO
     10: PRINT S(I,J): NEXT J: NEXT
     I
549  PRINT D$;"CLOSE";N$
550  PRINT "THIS PROGRAM WILL ALS
     O ALLOW YOU TO"
555  PRINT "VIEW THE OBJECT. DO Y
     OU WANT TO VIEW"
560  PRINT "THE OBJECT (Y/N)?";
570  GET A$: PRINT : PRINT : PRINT

580  IF A$ = "N" GOTO 620
590  IF A$ = "Y" GOTO 610
600  PRINT "ILLEGAL ENTRY, TRY AG
     AIN.": PRINT : PRINT : PRINT

610  PRINT D$;"RUN VIEW OBJECT"

620  END

]
```

The next program is "VIEWS". This program will allow you to view any object defined by "DEFINE OBJECT". It will allow you to use parallel projections, like front, top, and right side views. Or, you can use prespective projections. You can view the object from any angle and any distance. This program will allow you to move around to object any number of degrees and stoping along the way any number of times. Doing this is refered to as rotating about the object. This program will remove hidden lines. "VIEWS" also contains the subroutine Clip, as described in the section on "VIEW OBJECT". This progrm does not, however, run fast enough to do animation.

For example say you wanted to do a top, front, and right side projection of the object. For projection type you would use parallel. For scale you would use something large enough to make the object easily studied. For the top view set the angle off the x-axis at 90 and the off the z-axis at zero. Then for a front view rotate the x-axis 0 degrees and the z-axis 90 degrees. Finally for a right side view rotate x 90 degrees and z 0 degrees. Thus you have the three views.

Before running this program you must run allocate to allow for enough space. Here is a sample run and listing of the program.

The second program in the graphics group is "VIEW OBJECT". This program allows you to view any object defined by "DEFINE OBJECT". using this program you can view the object from any angle and at any distance, but all projections will be prespective, and all lines will be visible. "VIEW OBJECT" can be run independently or by the program "DEFINE OBJECT".

This program contains a subroutine called "Clip". Clip finds all the lines that would cause the program to try to plot off the screen and clips them to the screen's edge. If the line is entirely off the screen clip tells the program to skip plotting the line altogether. This is important because if the program should try to plot off the screen it would give an error message and stop running.

Here is a sample run and listing of the program.

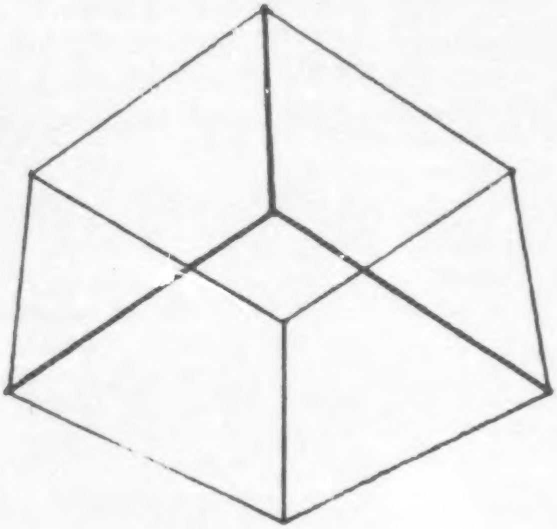
```
]RUN VIEW OBJECT
WHAT FILE DID YOU PUT THE OBJECT IN?CUBE



WHAT SIZE WINDOW DO YOU WANT?
PICK A SIZE LARGER THAN THE OBJECTS
LARGEST MEASUREMENT?20



WHAT ANGLE OFF THE X-AXIS DO YOU WANT
VIEW THE OBJECT FROM?45
WHAT ANGLE OFF THE Z-AXIS DO YOU WANT
TO VIEW THE OBJECT FROM ?135
PRESS ANY KEY TO CONTINUE?
```



```
DO YOU WISH TO:
        C. CHANGE VIEW
        E. EXIT PROGRAM



]LIST

540  DIM V(40,3),E(40,2),S(10,10)

541  PRINT "WHAT FILE DID YOU PUT
      THE OBJECT IN";: INPUT N$
542 D$ =  CHR$ (4)
543  HCOLOR= 3
544  PRINT D$;"OPEN";N$
545  PRINT D$;"READ ";N$
546  FOR I = 1 TO 40: INPUT V(I,1
     ): INPUT V(I,2): INPUT V(I,3
     ): NEXT I
547  FOR I = 1 TO 40: INPUT E(I,1
     ): INPUT E(I,2): NEXT I
548  FOR I = 1 TO 10: FOR J = 1 TO
     10: INPUT S(I,J): NEXT J: NEXT
     I
549  PRINT D$;"CLOSE";N$
570  PRINT : PRINT : PRINT
620 D = 279:R = 279:L = 0:T = 0:B
      = 191:SC = 280 / 192
625  PRINT "WHAT SIZE WINDOW DO Y
     OU WANT?"
630  PRINT "PICK A SIZE LARGER TH
     AN THE OBJECTS"
640  PRINT "LARGEST MEASUREMENT":

650  INPUT RH
660  PRINT : PRINT : PRINT
670  PRINT "WHAT ANGLE OFF THE X-
     AXIS DO YOU WANT"
680  PRINT "VIEW THE OBJECT FROM"
     ;: INPUT TH
682  IF TH < 360 GOTO 690
684 TH = TH - 360
686  GOTO 682
690 TH = TH * 3.141592654 / 180
700  PRINT "WHAT ANGLE OFF THE Z-
     AXIS DO YOU WANT"
710  PRINT "TO VIEW THE OBJECT FR
     OM ";: INPUT PH
712  IF PH < 360 GOTO 720
714 PH = PH - 360
716  GOTO 712
720 PH = PH * 3.141592654 / 180
```

```
725  HGR
730 S1 =  SIN (TH)
740 S2 =  SIN (PH)
750 C1 =  COS (TH)
760 C2 =  COS (PH)
770 I = 1
780  IF E(I,1) = 0 GOTO 990
785 RE = 0
790 X = V(E(I,1),1)
800 Y = V(E(I,1),2)
810 Z = V(E(I,1),3)
820 X1 =  - X * S1 + Y * C1
830 Y1 =  - X * C1 * C2 - Y * S1 *
     C2 + Z * S2
840 Z1 =  - X * S2 * C1 - Y * S2 *
     S1 - Z * C2 + RH
850 XF = D * (X1 / Z1) * SC + 140

860 YF = 96 - D * (Y1 / Z1)
870 X = V(E(I,2),1)
880 Y = V(E(I,2),2)
890 Z = V(E(I,2),3)
900 X2 =  - X * S1 + Y * C1
910 Y2 =  - X * C1 * C2 - Y * S1 *
     C2 + Z * S2
920 Z2 =  - X * S2 * C1 - Y * S2 *
     S1 - Z * C2 + RH
930 XT = D * (X2 / Z2) * SC + 140

940 YT = 96 - D * (Y2 / Z2)
950  GOSUB 1100
955  IF RE = 1 GOTO 970
960  HPLOT XF,YF TO XT,YT
970 I = I + 1
980  GOTO 780
990  PRINT "PRESS ANY KEY TO CONT
     INUE?": GET A$
1000  TEXT
1010  PRINT "DO YOU WISH TO:"
1020  PRINT  TAB( 10)"C. CHANGE V
     IEW"
1030  PRINT  TAB( 10)"E. EXIT PRO
     GRAM"
1040  GET A$: PRINT : PRINT : PRINT

1050  IF A$ = "C" GOTO 625
1060  IF A$ = "E" GOTO 1090
1070  PRINT "ILLEGAL ENTRY, TRY A
     GAIN.": PRINT : PRINT : PRINT

1080  GOTO 1010
1090  END
1092  REM  THIS IS A
```

```
1093  REM ROUTINE TO CLIP
1094  REM LINES BEING
1095  REM DRAWN TO THE
1096  REM SCREEN.
1097  REM
1100 L1 = 0:R1 = 0:T1 = 0:B1 = 0:
     L2 = 0:R2 = 0:T2 = 0:B2 = 0
1101  REM VARIABLES: L-LEFT
1102  REM R-RIGHT, T-TOP,
1103  REM B-BOTTOM. VARIA-
1104  REM BLES LIKE L1 CLIP
1105  REM THE FIRST POINT
1106  REM AND LIKE L2 CLIP
1107  REM THE SECOND.
1108  REM
1109  REM CLIP 1ST TO LEFT
1110  IF XF > = L GOTO 1130
1120 L1 = 1
1124  REM
1125  REM CLIP 1ST TO RIGHT
1126  REM
1130  IF XF < = R THEN 1150
1140 R1 = 1
1144  REM
1145  REM CLIP 1ST TO TOP
1146  REM
1150  IF YF > = T THEN 1170
1160 T1 = 1
1164  REM
1165  REM CLIP 1ST TO BOTTOM
1166  REM
1170  IF YF < = B THEN 1190
1180 B1 = 1
1188  REM
1189  REM CLIP 2ND TO LEFT
1190  IF XT > = L THEN 1210
1200 L2 = 1
1208  REM
1209  REM CLIP 2ND TO RIGHT
1210  IF XT < = R THEN 1230
1220 R2 = 1
1228  REM
1229  REM CLIP 2ND TO TOP
1230  IF YT > = T THEN 1250
1240 T2 = 1
1248  REM
1249  REM CLIP 2ND TO BOTTOM
1250  IF YT < = B THEN 1270
1260 B2 = 1
1261  REM
1262  REM ACCEPT LINE IF
1263  REM BOTH POINTS ARE
1264  REM WITHIN THE
```

```
1265  REM BOUNDERY.
1266  REM
1270  IF L1 <  > 0 OR L2 <  > 0 OR
     R1 <  > 0 OR R2 <  > 0 GOTO
     1290
1280  IF T1 = 0 AND T2 = 0 AND B1
      = 0 AND B2 = 0 THEN  RETURN

1281  REM
1282  REM IF RE=1 REJECT LINE
1290  IF L1 <  > 0 AND L2 <  > 0 THEN
     RE = 1
1291  IF R1 <  > 0 AND R2 <  > 0 THEN
     RE = 1
1293  IF T1 <  > 0 AND T2 <  > 0 THEN
     RE = 1
1294  IF B1 <  > 0 AND B2 <  > 0 THEN
     RE = 1
1300  IF RE = 1 THEN  RETURN
1301  REM
1302  REM THIS SECTION FINDS
1303  REM THE INTERSECTION OF
1304  REM THE LINE AND ONE OF
1305  REM BOUNDS, THEN SENDS
1306  REM THE LINE BACK
1307  REM THROUGH THE
1308  REM SUBROUTINE.
1309  REM  INTER. 1ST TO LEFT
1310  IF L1 <  > 1 GOTO 1350
1320 YF = YF + (YT - YF) * (L - X
     F) / (XT - XF)
1330 XF = L
1340  GOTO 1100
1344  REM
1345  REM INTER. 1ST WITH RIGHT
1346  REM
1350  IF R1 <  > 1 GOTO 1390
1360 YF = YF + (YT - YF) * (R - Y
     F) / (XT - XF)
1370 XF = R
1380  GOTO 1100
1384  REM
1385  REM 1ST WITH TOP
1386  REM
1390  IF T1 <  > 1 GOTO 1430
1400 XF = XF + (XT - XF) * (T - Y
     F) / (YT - YF)
1410 YF = T
1420  GOTO 1100
1424  REM
1425  REM 1ST WITH BOTTOM
1426  REM
1430  IF B1 <  > 1 GOTO 1470
```

```
1440 XF = XF + (XT - XF) * (B - Y
     F) / (YT - YF)
1450 YF = B
1460  GOTO 1100
1464  REM
1465  REM 2ND WITH LEFT
1466  REM
1470  IF L2 <  > 1 GOTO 1510
1480 YT = YF + (YT - YF) * (L - X
     F) / (XT - XF)
1490 XT = L
1500  GOTO 1100
1504  REM
1505  REM 2ND WITH RIGHT
1506  REM
1510  IF R2 <  > 1 GOTO 1550
1520 YT = YF + (YT - YF) * (R - X
     F) / (XT - XF)
1530 XT = R
1540  GOTO 1100
1544  REM
1545  REM 2ND WITH TOP
1546  REM
1550  IF T2 <  > 1 GOTO 1590
1560 XT = XF + (XT - XF) * (T - Y
     F) / (YT - YF)
1570 YT = T
1580  GOTO 1100
1584  REM
1585  REM 2ND WITH BOTTOM
1586  REM
1590  IF B2 <  > 1 GOTO 1100
1600 XT = XF + (XT - XF) * (B - Y
     F) / (YT - YF)
1610 YT = B
1620  GOTO 1100
1883  REM REJECT IF BOTH
1884  REM POINTS ARE OUTSIDE
1885  REM OF BOUNDERY.
1886  REM

]
```

The next program is "ALLOCATE". This program will move the starting address of any program in memory and the line counter to a new location. It will stay in effect until the machine is rebooted. This program should be run when a basic program is so large that the graphics page, or anything, causes it to bomb or be partially deleted. This program casues no echo to the screen so there is no sample run of it.

Here is a listing of the program.

```
LOAD ALLOCATE
]LIST

10  REM SOME OF THE GRAPHIC
20  REM PROGRAMS USE A LARGE
30  REM AMOUNT OF MEMORY, SO
40  REM IT MAY BE NECESSARY
50  REM TO RUN THIS PROGRAM
60  REM WHICH MOVES THE
70  REM PROGAM TO DIFFERENT
80  REM LOCATION IN MEMORY,
90  REM FOR THE GRAPHICS TO
100  REM WORK PROPERLY.
110  REM
120  REM THIS PROGRAM WILL
130  REM MOVE THE BASIC
140  REM PROGRAM THUS ALLOWING
150  REM THE SYSTEMS GRAPHICS
160  REM MORE SPACE.
170  REM
200  POKE 103,1
210  POKE 104,96
220  POKE 24576,0
230  END

]
```

```
]RUN ALLOCATE

]RUN VIEWS


    THIS IS A PROGRAM TO VIEW AN
OBJECT FROM SEVERAL DIFFERENT ANGLES.
         DEMONSTRATION PROGRAM
        FOR EDUCATIONAL USE ONLY



    PRESS <RETURN> TO CONTINUE?



    WHAT FILE IS THE OBJECT IN?HOUSE



    THIS PROGRAM WILL ALLOW YOU TO
USE TWO TYPES OF PROJECTIONS,
PARALLEL AND PRESPECTIVE.
    WHICH WOULD YOU PREFER:
         A. PARALLEL
         B. PRESPECTIVE



    WHAT SCALE FACTOR DO YOU WANT?40






    HOW MANY DEGREES OFF THE X AXIS DO
YOU WANT THE STARTING VIEWPOINT?90
HOW MANY DEGREES OFF THE Z-AXIS?0
WAIT`FOR`IMAGE
STILL`PROCESSING
ONE`MOMENT`PLEASE
THERE IS ABSOLUTLY NO CAUSE FOR CONCERN
PRESS ANY KEY TO CONTINUE?


    DO YOU WANT TO
         R. ROTATE THE OBJECT
         A. ALTER PROJECTION TYPE
         E. EXIT PROGRAM
    HOW MANY DEGREES ALONG THE
X-AXIS DO YOU WANT IT ROTATED?0
HOW MANY DEGREES ALONG THE Z-AXIS?90
HOW MANY STEPS DO YOU WANT?1
WAIT`FOR`IMAGE
STILL`PROCESSING
ONE`MOMENT`PLEASE
THERE IS ABSOLUTLY NO CAUSE FOR CONCERN
PRESS ANY KEY TO CONTINUE?


    DO YOU WANT TO
         R. ROTATE THE OBJECT
         A. ALTER PROJECTION TYPE
         E. EXIT PROGRAM



    HOW MANY DEGREES ALONG THE
X-AXIS DO YOU WANT IT ROTATED?90
HOW MANY DEGREES ALONG THE Z-AXIS?0
HOW MANY STEPS DO YOU WANT?1
WAIT`FOR`IMAGE
STILL`PROCESSING
ONE`MOMENT`PLEASE
THERE IS ABSOLUTLY NO CAUSE FOR CONCERN
PRESS ANY KEY TO CONTINUE?

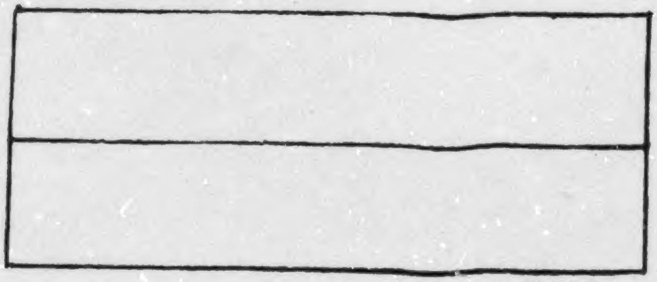

    DO YOU WANT TO
         R. ROTATE THE OBJECT
         A. ALTER PROJECTION TYPE
         E. EXIT PROGRAM

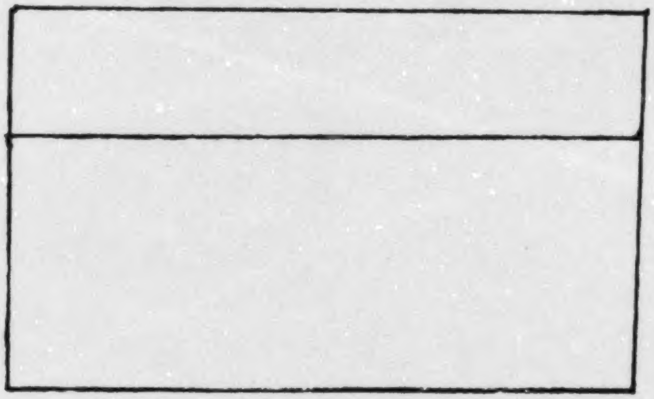
]LIST

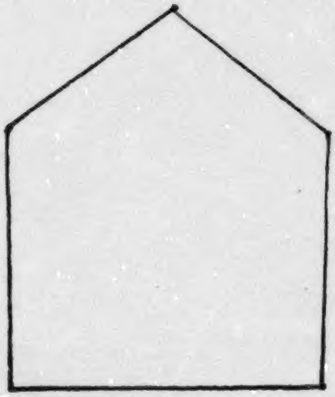
10  REM THIS PROGRAM WILL
12  REM ALLOW YOU TO VIEW
14  REM AN OBJECT FROM A
16  REM FILE CREATED BY THE
18  REM PROGRAM "DEFINE OBJECT".
20  REM
90  REM DIMENTION ARRAYS AND
92  REM SET VARIABLES.
100  DIM V(40,3),E(40,3),S(10,10)

110 D$ =  CHR$ (4)
120 L = 0:R = 279:T = 0:B = 191:S
```

```
]PR#0
```







```
     C = 280 / 192:D = 280
125  HCOLOR= 3
126  HOME : PRINT : PRINT : PRINT

130  PRINT  TAB( 5)"THIS IS A PRO
     GRAM TO VIEW AN"
140  PRINT "OBJECT FROM SEVERAL D
     IFFERENT ANGLES."
150  VTAB 10
151  INVERSE
152  HTAB 10: PRINT "DEMONSTRATIO
     N PROGRAM"
153  HTAB 9: PRINT "FOR EDUCATION
     AL USE ONLY"
154  NORMAL
155  PRINT : PRINT : PRINT
156  PRINT  TAB( 5)"PRESS <RETURN
     > TO CONTINUE";: INPUT A$
157  HOME : PRINT : PRINT : PRINT

160  PRINT  TAB( 5)"WHAT FILE IS
     THE OBJECT IN";: INPUT N$
170  PRINT D$;"OPEN";N$
180  PRINT D$;"READ";N$
190  FOR I = 1 TO 40
200  INPUT V(I,1)
210  INPUT V(I,2)
220  INPUT V(I,3)
230  NEXT I
240  FOR I = 1 TO 40
250  INPUT E(I,1)
260  INPUT E(I,2)
270 E(I,3) = 0
280  NEXT I
290  FOR I = 1 TO 10
300  FOR J = 1 TO 10
310  INPUT S(I,J)
320  NEXT J
330  NEXT I
340  PRINT D$;"CLOSE";N$
341  REM
342  REM FIND CENTER POINT
343  REM
350 P2 = V(1,2):Q2 = V(1,2)
360 P3 = V(1,3):Q3 = V(1,3)
370  FOR I = 2 TO 40
380  IF V(I,1) > P1 THEN P1 = V(I
     ,1)
390  IF V(I,1) < Q1 THEN Q1 = V(I
     ,1)
400  IF V(I,2) > P2 THEN P2 = V(I
     ,2)
410  IF V(I,2) < Q2 THEN Q2 = V(I
     ,2)
420  IF V(I,3) > P3 THEN P3 = V(I
     ,3)
430  IF V(I,3) < Q3 THEN Q3 = V(I
     ,3)
440  NEXT I
450 CX = P1 - Q1
455 CX = CX / 2
460 CX = P1 - CX
470 CY = P2 - Q2
475 CY = CY / 2
480 CY = P2 - CY
490 CZ = P3 - Q3
495 CZ = CZ / 2
500 CZ = P3 - CZ
505  REM
506  REM LOOP TO FIND A NORMAL
507  REM POINT ON EACH SIDE
508  REM
510 I = 1
520  IF S(I,1) = 0 GOTO 610
530 P1 = (V(E(S(I,1),2),1) - CX) -
     (V(E(S(I,1),1),1) - CX)
540 P2 = (V(E(S(I,1),2),2) - CY) -
     (V(E(S(I,1),1),2) - CY)
550 P3 = (V(E(S(I,1),2),3) - CZ) -
     (V(E(S(I,1),1),3) - CZ)
560 Q1 = (V(E(S(I,2),2),1) - CX) -
     (V(E(S(I,1),1),1) - CX)
570 Q2 = (V(E(S(I,2),2),2) - CY) -
     (V(E(S(I,1),1),2) - CY)
580 Q3 = (V(E(S(I,2),2),3) - CZ) -
     (V(E(S(I,1),1),3) - CZ)
581 N(I,1) = P2 * Q3 - Q2 * P3
582 N(I,2) = P3 * Q1 - Q3 * P1
583 N(I,3) = P1 * Q2 - Q1 * P2
590 I = I + 1
600  GOTO 520
605  REM
610  PRINT : PRINT : PRINT : PRINT
      TAB( 5)"THIS PROGRAM WILL A
     LLOW YOU TO"
620  PRINT "USE TWO TYPES OF PROJ
     ECTIONS,"
630  PRINT "PARALLEL AND PRESPECT
     IVE."
640  PRINT  TAB( 5)"WHICH WOULD Y
     OU PREFER:"
650  PRINT  TAB( 10)"A. PARALLEL"

660  PRINT  TAB( 10)"B. PRESPECTI
     VE"
670  GET A$: PRINT : PRINT : PRINT
```

```
675  REM
676  REM FOR PARALLEL SET
677  REM VIEWPOINT AT INFINITY
678  REM (1000), AND SET SCALE
679  REM
680  IF A$ <  > "A" GOTO 730
690 RH = 1000
700  PRINT  TAB( 5)"WHAT SCALE FA
     CTOR DO YOU WANT";: INPUT SL

710  PRINT : PRINT : PRINT
720  GOTO 810
722  REM
723  REM FOR PRESPECTIVE SET
724  REM SCALE TO 1, AND SET
725  REM VIEWPOINT.
726  REM
730  IF A$ <  > "B" GOTO 790
740 SL = 1
750  PRINT  TAB( 5)"WHAT SIZE WIN
     DOW DO YOU WANT?"
760  PRINT "THIS SIZE SHOULD BE L
     ARGER THAN THE      OBJECT.";

770  INPUT RH
780  GOTO 810
785  REM
790  PRINT : PRINT : PRINT : PRINT
      TAB( 5)"ILLEGAL ENTRY, TRY
     AGAIN.": PRINT : PRINT : PRINT

800  GOTO 640
810  PRINT : PRINT : PRINT
820  PRINT  TAB( 5)"HOW MANY DEGR
     EES OFF THE X AXIS DO"
830  PRINT "YOU WANT THE STARTING
      VIEWPOINT";: INPUT TH
840 TH = TH * 3.141592654 / 180
850  PRINT "HOW MANY DEGREES OFF
     THE Z-AXIS";: INPUT PH
860 PH = PH * 3.141592654 / 180
870  GOSUB 1100
875  GOSUB 7250
880  PRINT : PRINT : PRINT
890  PRINT  TAB( 5)"DO YOU WANT T
     O"
900  PRINT  TAB( 10)"R. ROTATE TH
     E OBJECT"
910  PRINT  TAB( 10)"A. ALTER PRO
     JECTION TYPE"
920  PRINT  TAB( 10)"E. EXIT PROG
     RAM"
```

```
930  GET A$
940  IF A$ = "A" GOTO 610
950  IF A$ <  > "R" GOTO 1090
960  PRINT : PRINT : PRINT
970  PRINT  TAB( 5)"HOW MANY DEGR
     EES ALONG THE"
980  PRINT "X-AXIS DO YOU WANT IT
      ROTATED";: INPUT TE
990  PRINT "HOW MANY DEGREES ALON
     G THE Z-AXIS";: INPUT PI
1000  PRINT "HOW MANY STEPS DO YO
     U WANT";: INPUT L
1010 TE = TE / L:PI = PI / L
1020 TE = TE * 3.141592654 / 180
1030 PI = PI * 3.141492654 / 180
1040  FOR K = 1 TO L
1050 TH = TH + TE:PH = PH + PI
1060  GOSUB 1100
1065  GOSUB 7250
1070  NEXT K
1080  GOTO 880
1090  TEXT : END
1092  REM
1094  REM SUBROUTINE: REMOVE
1096  REM HIDDEN LINES.
1098  REM
1100 S1 =  SIN (TH)
1101 S2 =  SIN (PH)
1102 C1 =  COS (TH)
1104 C2 =  COS (PH)
1110 XE = RH * S2 * C1
1115 YE = RH * S2 * S1
1120 ZE = RH * C2
1124  REM
1125  REM LOOP: CHECK FOR VISIBLE

1126  REM SURFACE
1127  REM
1130 I = 1
1135  FLASH : PRINT "WAIT FOR IMA
     GE": NORMAL
1140  IF S(I,1) = 0 GOTO 1260
1150 WX = XE - (V(E(S(I,1),1),1) -
     CX)
1160 WY = YE - (V(E(S(I,1),1),2) -
     CY)
1170 WZ = ZE - (V(E(S(I,1),1),3) -
     CZ)
1180  IF N(I,1) * WX + N(I,2) * W
     Y + N(I,3) * WZ > 0 GOTO 124
     0
1184  REM
1185  REM LOOP: SET VISIBLE
```

```
1186  REM EDGES
1187  REM
1190  FOR J = 1 TO 10
1200  IF S(I,J) = 0 GOTO 1230
1210 E(S(I,J),3) = 1
1230  NEXT J
1240 I = I + 1
1250  GOTO 1140
1253  REM NESTED LOOPS: FIND
1254  REM ALL EDGES THAT
1255  REM ARE SET TO BE DRAWN
1256  REM TWICE AND RESET
1257  REM EXTRA EDGES.
1258  REM
1260  FOR I = 1 TO 40
1262  IF I = 10 THEN  FLASH : PRINT
     "STILL PROCESSING"
1264  IF I = 20 THEN  PRINT "ONE
     MOMENT PLEASE"
1266  IF I = 30 THEN  INVERSE : PRINT
     "THERE IS ABSOLUTLY NO CAUSE
      FOR CONCERN": NORMAL
1270  IF E(I,3) <  > 1 GOTO 1330
1280  FOR J = 1 TO 40
1285  IF J = I GOTO 1320
1290  IF E(I,1) <  > E(J,1) AND E
     (I,1) <  > E(J,2) GOTO 1320
1300  IF E(I,2) <  > E(J,1) AND E
     (I,2) <  > E(J,2) GOTO 1320
1310 E(J,3) = 0
1320  NEXT J
1330  NEXT I
1350  RETURN
7200  REM
7210  REM DRAW THE OBJECT
7220  REM
7230  PRINT " ": PRINT " ": PRINT
     " ": PRINT " ": PRINT " "
7250  HGR
7260  POKE 34,20
7270  HOME
7700 I = 1
7800  IF E(I,1) = 0 GOTO 9850
7805  IF E(I,3) = 0 GOTO 9700
7850 RE = 0
7900 X = V(E(I,1),1) - CX
8000 Y = V(E(I,1),2) - CY
8100 Z = V(E(I,1),3) - CZ
8200 X1 =  - X * S1 + Y * C1
8300 Y1 =  - X * C1 * C2 - Y * S1
      * C2 + Z * S2
8400 Z1 =  - X * S2 * C1 - Y * S2
      * S1 - Z * C2 + RH
```

```
8500 XF = (D * (X1 / Z1) * SC * S
     L) + 140
8600 YF = 96 - (D * (Y1 / Z1) * S
     L)
8700 X = V(E(I,2),1) - CX
8800 Y = V(E(I,2),2) - CY
8900 Z = V(E(I,2),3) - CZ
9000 X2 =  - X * S1 + Y * C1
9100 Y2 =  - X * C1 * C2 - Y * S1
      * C2 + Z * S2
9200 Z2 =  - X * S2 * C1 - Y * S2
      * S1 - Z * C2 + RH
9300 XT = (D * (X2 / Z2) * SC * S
     L) + 140
9400 YT = 96 - (D * (Y2 / Z2) * S
     L)
9440  REM
9450  REM CALL CLIP
9460  REM
9500  GOSUB 11000
9550  IF RE = 1 GOTO 9700
9600  HPLOT XF,YF TO XT,YT
9700 I = I + 1
9800  GOTO 7800
9850  FOR I = 1 TO 40:E(I,3) = 0:
      NEXT I
9900  PRINT "PRESS ANY KEY TO CON
     TINUE?": GET A$
10000  RETURN
10100  PRINT "DO YOU WISH TO:"
10200  PRINT  TAB( 10)"C. CHANGE
     VIEW"
10300  PRINT  TAB( 10)"E. EXIT PR
     OGRAM"
10400  GET A$: PRINT : PRINT : PRINT

10500  IF A$ = "C" GOTO 625
10600  REM
10610  REM SUBROUTINE: CLIP
10620  REM ALL LINES SO THAT
10630  REM THEY DO NOT GO
10640  REM PAST THE SCREEN
10650  REM EDGE
10660  REM
11000 L1 = 0:R1 = 0:T1 = 0:B1 = 0
     :L2 = 0:R2 = 0:T2 = 0:B2 = 0

11090  REM CLIP FIRST POINT
11100  IF XF >  = L GOTO 11300
11200 L1 = 1
11300  IF XF <  = R THEN 11500
11400 R1 = 1
11500  IF YF >  = T THEN 11700
```

```
11600 T1 = 1
11700  IF YF <  = B THEN 11900
11790  REM CLIP SECOND POINT
11800 B1 = 1
11900  IF XT >  = L THEN 12100
12000 L2 = 1
12100  IF XT <  = R THEN 12300
12200 R2 = 1
12300  IF YT >  = T THEN 12500
12400 T2 = 1
12500  IF YT <  = B THEN 12700
12600 B2 = 1
12700  IF L1 <  > 0 OR L2 <  > 0 OR
     R1 <  > 0 OR R2 <  > 0 GOTO
     12900
12800  IF T1 = 0 AND T2 = 0 AND B
     1 = 0 AND B2 = 0 THEN  RETURN

12900  IF L1 <  > 0 AND L2 <  > 0
      THEN RE = 1
12910  IF R1 <  > 0 AND R2 <  > 0
      THEN RE = 1
12930  IF T1 <  > 0 AND T2 <  > 0
      THEN RE = 1
12940  IF B1 <  > 0 AND B2 <  > 0
      THEN RE = 1
13000  IF RE = 1 THEN  RETURN
13100  IF L1 <  > 1 GOTO 13500
13200 YF = YF + (YT - YF) * (L -
     XF) / (XT - XF)
13300 XF = L
13400  GOTO 11000
13500  IF R1 <  > 1 GOTO 13900
13600 YF = YF + (YT - YF) * (R -
     YF) / (XT - XF)
13700 XF = R
13800  GOTO 11000
13900  IF T1 <  > 1 GOTO 14300
14000 XF = XF + (XT - XF) * (T -
     YF) / (YT - YF)
14100 YF = T
14200  GOTO 11000
14300  IF B1 <  > 1 GOTO 14700
14400 XF = XF + (XT - XF) * (B -
     YF) / (YT - YF)
14500 YF = B
14600  GOTO 11000
14700  IF L2 <  > 1 GOTO 15100
14800 YT = YF + (YT - YF) * (L -
     XF) / (XT - XF)
14900 XT = L
15000  GOTO 11000
15100  IF R2 <  > 1 GOTO 15500
```

```
15200 YT = YF + (YT - YF) * (R -
     XF) / (XT - XF)
15300 XT = R
15400  GOTO 11000
15500  IF T2 <  > 1 GOTO 15900
15600 XT = XF + (XT - XF) * (T -
     YF) / (YT - YF)
15700 YT = T
15800  GOTO 11000
15900  IF B2 <  > 1 GOTO 11000
16000 XT = XF + (XT - XF) * (B -
     YF) / (YT - YF)
16100 YT = B
16200  GOTO 11000

]
```

The second program is "ISOMETRIC". This program will give the starting point for a isometric drawing given width and hieght of the drawing area, and the width, depth, and hieght of the object to be drawn. For example say you want to draw an object that has a width of 4 inches, a depth of 3 inches, and a height of 2 inches. Say you want to draw this object in an area 10 inches by 7 inches. this program will let you pick a scale to draw it in and then either give you the starting point are tell the scale is too large and have you pick another.

Here is a sample run and listing of the program.

```
RUN ISOMETRIC


     THIS IS A PROGRAM TO CENTER A
ISOMETRIC DRAWING OF AN OBJECT IN A
GIVEN DRAWING AREA.


     THIS PROGRAM WILL WORK WITH EITHER
ENGLISH OR METRIC UNITS OF MESUREMENT.


     ENTER THE WIDTH OF YOUR DRAWING
AREA?10
     ENTER THE HIEGHT OF YOUR DRAWING
AREA?7


DIMENSIONS OF THE OBJECT TO BE DRAWN.
     ENTER THE WIDTH    ?4
     ENTER THE DEPTH    ?3
     ENTER THE HIEGHT   ?2


     ENTER THE SCALE FACTOR, i. e.
1 = FULL SIZE; 2 = DOUBLE SIZE;
.5 = HALF SIZE; .25 = 1/4th SIZE;
?7


     THE DRAWING IS TO LARGE FOR THE
AREA. PLEASE PICK A DIFFERENT SCALE.


     ENTER THE SCALE FACTOR, i. e.
1 = FULL SIZE; 2 = DOUBLE SIZE;
.5 = HALF SIZE; .25 = 1/4th SIZE;
?1
```

```
     THE STARTING POINT SHOULD BE 5.43
UNITS FROM THE LEFT EDGE OF THE AREA,
AND .75 UNITS FROM THE BOTTOM EDGE
OF THE AREA.







DO YOU WANT TO RE-RUN THE PROGRAM (Y/N)?
]LIST

10  REM THIS PROGRAM WILL
20  REM HELP YOU CENTER AN
30  REM ISOMETRIC DRAWING.
40  HOME : PRINT : PRINT : PRINT

50  PRINT  TAB( 5)"THIS IS A PROG
     RAM TO CENTER A"
60  PRINT "ISOMETRIC DRAWING OF A
     N OBJECT IN A"
70  PRINT "GIVEN DRAWING AREA."
80  PRINT : PRINT : PRINT
82  PRINT  TAB( 5)"THIS PROGRAM W
     ILL WORK WITH EITHER"
84  PRINT "ENGLISH OR METRIC UNIT
     S OF MESUREMENT."
85  PRINT : PRINT : PRINT
90  PRINT  TAB( 5)"ENTER THE WIDT
     H OF YOUR DRAWING"
95  PRINT "AREA";: INPUT W
100  PRINT  TAB( 5)"ENTER THE HIE
     GHT OF YOUR DRAWING"
105  PRINT "AREA";: INPUT H
110  PRINT : PRINT : PRINT
115  PRINT "DIMENSIONS OF THE OBJ
     ECT TO BE DRAWN."
120  PRINT  TAB( 5)"ENTER THE WID
     TH   ";: INPUT W2
140  PRINT  TAB( 5)"ENTER THE DEP
     TH   ";: INPUT D1
150  PRINT  TAB( 5)"ENTER THE HIE
     GHT  ";: INPUT H2
151  REM
152  REM ENTER SCALE
153  REM
154  PRINT : PRINT : PRINT
155  PRINT  TAB( 5)"ENTER THE SCA
     LE FACTOR, i. e."
156  PRINT "1 = FULL SIZE; 2 = DO
     UBLE SIZE; "
```

```
157  PRINT ".5 = HALF SIZE; .25 =
      1/4th SIZE;"
158  INPUT SC: PRINT : PRINT : PRINT
     : PRINT
159 WO = W2 * SC:D = D1 * SC:H1 =
     H2 * SC
160  REM
170  REM COMPUTE THE CENTER.
180  REM
190 X = WO * .5
200 Y = D * .5
210 Z = X + Y + H1
220 PC =  COS (30 * 3.1416 / 180)

230 X1 = WO * PC
340 Y1 = D * PC
350 Z1 = X1 + Y1
360 I = (W - Z1) / 2 + X1
370 J = (H - Z) / 2
374 I =  INT (I * 100 + .5) / 100

375 J =  INT (J * 100 + .5) / 100

380  HOME : PRINT : PRINT : PRINT
     : PRINT : PRINT : PRINT
385  IF Z1 > W OR J < 0 GOTO 440
390  PRINT  TAB( 5)"THE STARTING
     POINT SHOULD BE ";I
400  PRINT "UNITS FROM THE LEFT E
     DGE OF THE AREA,"
410  PRINT "AND ";J;" UNITS FROM
     THE BOTTOM EDGE"
415  PRINT "OF THE AREA."
420  PRINT : PRINT : PRINT : PRINT
     : PRINT
430  GOTO 600
440  FOR S = 1 TO 200:A = S * 1: NEXT
     S
442  INVERSE
445  PRINT  TAB( 5)"THE DRAWING I
     S TO LARGE FOR THE"
450  PRINT "AREA. PLEASE PICK A D
     IFFERENT SCALE."
455  NORMAL
460  GOTO 154
600  PRINT : PRINT : PRINT
610  PRINT "DO YOU WANT TO RE-RUN
      THE PROGRAM (Y/N)?";: GET X
     $
620  IF X$ = "N" GOTO 700
630  IF X$ = "Y" GOTO 85
640  GOTO 600
700  HOME
710  END

]
```

RADIO SHACK TRS-80 AUTHOR I Lesson: TEXT2
Version: 01/10/84 Page: 02 of 03 Page type: TEXT

PROGRAM 7. CABINET DRAWING ROUTINES

This program was designed to demonstrate the ability of a small, inexpensive (relatively) system to aid in drafting and design fields.

The program draws fairly clear and numerous combinations of kitchen cabinets. An entire kitchen can be easily designed and redesigned completely from menu choices.

Some knowledge of drafting terms is helpful, but not neccessary. A few experiments will

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 RADIO SHACK  TRS-80 AUTHOR I     Lesson: TEXT2
Version: 01/10/84        Page: 03 of 03   Page type: TEXT

---------------------------------------------------------------------
!     .                                                              !

!     .      illustrate the different cabinets available             !

!     .      if the names are not familiar.                          !

!     .                                                              !

!     .        In order to draw cabinets that are left of            !

!     .      the current pen position, a NO CABINET MOVE             !

!     .      LEFT choice should be selected and then the             !

!     .      appropriate distance in inches entered.  A              !

!     .      wall cabinet is one instance of this if it is           !

!     .      requested after drawing a base cabinet.                 !

      .                                                              !

!     .        The plotter should be reset to REMOTE  before         !

!     .      and after each use or if a mistake is made.             !
---------------------------------------------------------------------
```

```
10 '******** CABINET DRAWING ROUTINES **************
20 '
30 '  THIS PROGRAM WILL AID IN THE LAYOUT OF CABINETS.
40 'THERE ARE SEVERAL CHOICES OF SCALE AND DIMENSIONS
50 'TO CHOSE FROM.  ALL SELECTIONS ARE MENU DRIVEN AND
60 'INPUT PROTECTED. THE PROGRAM IS DESIGNED TO RUN ON
70 'TRS-80 MODEL III WITH A MULTI PEN PLOTTER.
72 '  THIS PROGRAM IS DESIGNED SO ADDITIONAL ROUTINES CAN
73 'BE ADDED EASILY. AN ADDITION TO THE MENU AND JUMP
74 'TABLE WILL SET UP ANY NEW SUBROUTINE ADDED AT THE END.
75 '   THERE ARE EXAMPLES OF SEVERAL TYPES OF PLOTTER ROUTINES
76 ' IN THIS LISTING. THE SCALE USED IS 1/2 IN. = 1 FOOT, BUT
77 ' THIS IS ALSO EASILY CHANGED BY REPLACING THE VERTICAL
78 ' CONSTANTS BY A VARIABLE AS THE HORIZONTAL VALUES ARE.
79 ' THE SCALE MENU WAS REMOVED IN THIS VERSION DUE TO TIME
80 ' LIMITATIONS FROM LINE NUMBERS 350-400.
81 '
82 '                           MIKE PAINES     6-83
83 '
90 ON ERROR GOTO 5000
95 CLEAR 4500
100 GOSUB 7000 '        ** SET UP PLOTTER PORTS
110 '
120 ' **************** MAIN MENU **********************
130 '
140 CLS:PRINT@70,"PLEASE PRESS ENTER AFTER EVERY ANSWER "
150 PRINT@463,"WHAT IS YOUR FIRST NAME ?"
160 INPUT FIR$
170 PRINT@591,"WHAT IS YOUR LAST NAME ?"
180 INPUT LN$
190 PRINT@778,"WHAT CLASS ARE YOU ENROLLED IN ? "
200 INPUT CL$
210 CLS
212 PRINT@335,"WHAT SCHOOL ARE YOU FROM ?"
213 INPUT SC$
214 PRINT@463,'ENTER THE DATE IN THE  FORM OF MO-DAY-YR":PRINT
215 INPUT DA$
216 '
217 XX=0: GOSUB 8000 ' DRAW BORDER AND TITLE
218 '
400 S = 8.333
405 '
407 ' **************  CABINET TYPE MENU *****************
410 '
411 CLS:PRINT@332,"   WHICH ROOM ARE THE CABINETS FOR ? " :PRINT
420 '
430 CLS:PRINT"CHOOSE THE NUMBER OF THE CABINET TO BE DRAWN ":PRINT
432 FL=0
440 PRINT "     (1)   BASE                 (14)   WALL "
450 PRINT "     (2)   BLIND RIGHT BASE     (15)   BLIND RIGHT WALL"
460 PRINT'     (3)   BLIND LEFT BASE     (16)   BLIND LEFT WALL"
470 PRINT "     (4)   FOUR DRAWER BASE     (17)   OVEN    "
480 PRINT "     (5)   SINK                 (18)   DOUBLE OVEN"
490 PRINT "     (6)   DISHWASHER           (19)   FURRED CEILING"
500 PRINT "     (7)   TRASH COMPACTOR      (20)   STORAGE"
510 PRINT "     (8)   RANGE                (21)   DESK  "
520 PRINT "     (9)   TRAY STORAGE         (22)   MANUAL CONTROL
```

```
530 PRINT "    (10)    TOWEL DRYER             (23)    RETURN TO MAIN MENU"
540 PRINT "    (11)    ROTATING CORNER RT. (24)    NO CAB. MOVE RT. "
550 PRINT"    (12)  TORONG CORNER L.T. (25)    NO CAB. MOVE L.T.
552 PRINT "    (13)    WALL W/ HOOD              (26)    EXIT PROGRAM "
560 INPUT TY: IF TY = 23 THEN 120
561 IF TY = 26 THEN 4950
562 IF TY = 24 THEN  GOSUB 3000
563 IF TY = 25 THEN GOSUB 3500
564 IF FL = 1 THEN 430
565 IF TY>0AND TY<28 THEN570
566 CLS:PRINT"ENTER A NUMBER BETWEEN 1 AND 25 ONLY."
567 FOR X=1TO 150:NEXT X:GOTO 430
570 IF TY >13 AND TY <17 THEN GOSUB 1500
573 IF TY = 22 OR TY = 6  OR TY = 7   THEN 642
575 GOSUB 2500
580 XX = XX + WY
600 IF TY=1 AND WY=27 THEN GOTO  12000
642 GOSUB 9000
644 GOTO 430
849 '
850 ' MANUEL PLOT ROUTINE **************
855 LPRINT C$
860 H = USR3(0)
865 RETURN
900 '
905 ' PLOTTER CONTROL ROUTINE ************
910 '
915 LPRINT"  ;:   R  "
920 LPRINT " ";X;" ";Y;" "
922 FL=1
925 H = USR3(0) ' **** WAIT FOR BUFFER RESPONSE ****
930 RETURN
932 '
934 ' ***** SUBROUTINE DOWN ******
936 '
938 LPRINT " ;: R D "
940 RETURN
942 '
944 ' ****** SUBROUTINE UP *******
946 '
948 LPRINT " ;: R U "
950 RETURN
952 '
954 ' ****** SUBROUTINE ASSIGN ORIGIN **
956 '
958 LPRINT " ;: O "
960 RETURN
962 '
964 ' ******* SUBROUTINE GOTO ORIGIN **
966 '
968 LPRINT " ;: A 0,0 R "
970 RETURN
972 '
974 ' ******* SUBROUTINE KNOB **********
976 '
978 LPRINT ";: CC 0,4 "
980 RETURN
1000 '
1010 ' ***** SINK AND BASE ROUTINES **
1020 '
1030 WID = INT(S*WY)
1032 GOSUB 934
```

```
1040 X = WID: Y = 0 :GOSUB 700: GOSUB 956
1041 IF TY = 5 OR TY = 9 OR TY = 10  OR TY = 4 OR TY = 6 OR
     TY = 7 THEN 1050
1042 SH=INT (17.5*S)
1043 GOSUB 944
1044 X=0   :Y=SH:GOSUB 900:GOSUB 934
1045 X=-WID:Y=0
1046 LPRINT " :: L3"
1047 GOSUB 900:GOSUB 944
1048 LPRINT " :: L0 A 0,0 R D "
1050 Y = 288 : X = 0 :GOSUB 900
1060 Y = 0 : X = -WID : GOSUB 900
1070 Y = -288   : X = 0: GOSUB 900
1080 X = 0 : Y = 33  : GOSUB 900
1090 X = WID : Y = 0: GOSUB 900
1100 GOSUB 944
1110 X = 0:Y = 267:GOSUB 900
1120 GOSUB 934
1122 X = -WID : Y = 0 :GOSUB 900
1124 GOSUB 944
1126 X=4 :Y=-263   :GOSUB 900
1128 GOSUB 934: IF TY = 4 OR TY = 6 OR TY = 7 THEN RETURN
1130 IF WY > 27 THEN 1200
1131 '
1132 ' **************** ONE DOOR ROUTINE *****
1134 '
1136 WID = WID - 8
1138 X=WID:Y=0:GOSUB 900
1140 X=0:Y=191 : GOSUB 900
1142 X=-WID:Y=0: GOSUB 900
1144 X=0:Y=-191   : GOSUB 900
1146 GOSUB 944
1148 X=0:Y=197 : GOSUB 900
1150 GOSUB 934
1152 X=WID:Y=0:GOSUB 900
1154 X=0:Y=50 :GOSUB 900
1156 X=-WID:Y=0:GOSUB 900
1158 X=0:Y=-50  :GOSUB 900
1160 GOSUB 944
1162 X=INT(WID/2):Y=25 :GOSUB 900
1163 IF TY = 5 OR TY = 8 THEN 1166
1164 GOSUB 974
1166 CLS :PRINT "DO YOU WANT THE KNOB ON THE LEFT (L) OR
     RIGHT (R) OF THE CABINET DOOR ? "
1168 K$ = INKEY$ : IF K$ = "" THEN 1168
1170 IF K$ = "L" THEN  1176
1172 IF K$="R" THEN 1184
1174 GOTO 1166
1176 X=-INT((WID/2)-20):Y=-64  :GOSUB 900
1178 GOSUB 974:GOSUB 944:WID = WID+8
1180 X=0:Y=-(260 ):GOSUB 900
1182  GOTO 1400 ' GO TO LABEL ROUTINE
1184 X=INT(WID/2-20):Y=-64:GOSUB 900
1186 GOSUB 974: GOSUB 944: WID = WID + 8
1188 X=-(WID-40): Y=-252  : GOSUB 900
1190 '
1193 GOTO 1400 ' GOTO LABEL ROUTINE
1200 '
```

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```
1202 '  ****** TWO DOOR ROUTINE  *******
1204 '
1206 GOSUB 934:DWI=INT((WID-14)/2)
1208 X=DWI:Y=0 :GOSUB 900
1210 X = 0:Y=191 :GOSUB 900
1212 X=-DWI:Y=0:GOSUB 900
1214 X=0: Y=-191   : GOSUB 900
1216 GOSUB 944
1218 X=DWI+6:Y=0:GOSUB 900
1220 GOSUB 934
1222 X=DWI:Y=0:GOSUB 900
1224 X=0:Y=191 : GOSUB 900
1226 X=-DWI:Y=0:GOSUB 900
1228 X=0:Y=-191  :GOSUB 900
1230 GOSUB 944
1232 X=0:Y=197 :GOSUB 900
1234 GOSUB 934
1236 X=DWI:Y=0 :GOSUB 900
1238 X=0:Y=50 : GOSUB 900
1239 IF TY = 5 OR TY = 8 THEN 1270
1240 X=-DWI:Y=0: GOSUB 900
1242 X=0:Y=-50    :GOSUP 900:GOSUP944
1244 X=-4:Y=0:GOSUB 900:GOSUB 934: X=0:Y=50:GOSUB 900:X=-DWI
     :Y=0:GOSUB 900
1245 X=0: Y=-50   : GOSUB 900:X=DWI:Y=0:GOSUB 900
1246 GOSUB 944:X=INT(DWI/2):Y=25 : GOSUB 900:GOSUB 934
1248 GOSUB 974:GOSUB 944
1250 X=-(DWI):Y=0:GOSUB 900
1252 GOSUB 974:GOSUB 944
1254 X=INT((DWI/2)-20) :GOSUB 900
1255 X=0 :Y=-64:GOSUB 900
1256 GOSUB 974:GOSUB 944
1258 X=46: Y=0 :GOSUB 900:GOSUB 974:GOSUB 944
1260 X=-INT(10+DWI):Y=-260   : GOSUB 900
1262 GOTO 1400
1265 ' ***** SINK ROUTINE *****
1270 X = -(2*DWI+6):Y = 0:GOSUB 900
1272 X = 0: Y = -50: GOSUB 900
1274 X = DWI + 6:Y = 0: GOSUB 900
1276 GOSUB 944
1278 X = -INT(DWI/2+6): Y = 0 :GOSUB 900
1279 X=0:Y=14: GOSUB 920
1280 GOTO 1254
1400 ' LABEL ROUTINE ************
1401 IF TY = 2 OR TY = 3 OR TY = 9 OR TY = 10 OR TY = 8 THEN RETURN
1402 SB$="B."
1403 IF TY=5 THEN SB$="S."
1404 LPRINT " :: S12 ";+ SB$
1406 LPRINT STR$ (WY);CHR$(95)
1407 GOSUB 964
1408 LPRINT " U A 0,0 "
1409 RETURN
1410 '
1500 '************DETERMINE HEIGHT ****************
1501 '
1510 CLS:PRINT"CHOOSE AN APPROPRIATE HEIGHT FOR THE CABINET."
1520 PRINT
1530 PRINT"WALL CABINETS CAN BE 12, 15, 18, 24 OR 32 INCHES HIGH"
```

```
1550 PRINT  "JUST ENTER THE HEIGHT (OF THE CHOICES ABOVE) YOU WISH YOUR"
1551 PRINT"CABINET TO BE"
1560 INPUT HT
1570 IF HT<>12AND HT<>15ANDHT<>18AND HT<>24ANDHT<>32ANDHT<>44ANDHT
     <>63ANDHT<>84 THEN1600
1580 RETURN
1590 '
1600 PRINT"ENTER ONE OF THE SELECTIONS ONLY.":FOR G= 1 TO 150:NEXT
     G: GOTO 1500
2499 '
2500 ' *********** DETERMINE WIDTH ***************
2501 '
2510 CLS:PRINT"  CHOOSE AN APPROPRIATE WIDTH FOR YOUR CABINETS. THE "
2520 PRINT" CABINETS LISTED BELOW COME IN THREE (3) INCH INCREMENTS
     ONLY.  CHOOSE YOUR WIDTH IN THE RANGES LISTED FOR THE CABINET WA
NTED.  ENTER YOUR VALUE IN INCHES."
2540 PRINT"         KITCHEN           *"
2550 PRINT "--------------------------"
2560 PRINT"    BASE           12-51    *"
2570 PRINT"    BLIND BASES 36-51    *"
2580 PRINT"    SINK           24-72    *"
2590 PRINT"    WALL           24-51    *"
2600 PRINT"    BLIND WALL  24-75    *"
2610 PRINT"    OVEN           24-36    *"
2620 PRINT"    BROOM          12-48    *"
2630 PRINT"    STORAGE        12-48    *"
2635 PRINT"    RANGE          24-51    * "
2636 PRINT"    DESK           24-36    * "
2640 '
2650 INPUT WY:TEM=WY
2660 FOR R=1 TO 35
2665 TEM=TEM-3
2670 IF TEM=0THEN R=35
2672 NEXT R
2673 IF WY<06OR WY >51  THEN2676
2674 IF TEM=0 THEN 2900
2676 PRINT " ENTER A VALUE IN THE RANGE ONLY":FOR F=1 TO 1000:
     NEXTF:GOTO 2500
2701 GOTO 4950
2900 RETURN
2999 '
3000 ' MOVE RIGHT ROUTINE *************
3005 '
3010 CLS:PRINT "ENTER THE DISTANCE YOU WISH TO MOVE RIGHT IN INCHES"
3015 INPUT MR:X = INT(MR * S):Y = 0
3020 GOSUB 900:GOSUB 954
3022 XX = XX + ML
3025 RETURN
3499 '
3500 'MOVE LEFT ROUTINE **********
3505 '
3510 CLS:PRINT "ENTER THE DISTANCE YOU WISH TO MOVE LEFT IN INCHES"
3515 INPUT ML:X=-INT(ML*S):Y=0
3520 GOSUB 900 :GOSUB 954
3525 RETURN
4950 LPRINT ";: P0 H Z @ " :DEFUSR2=&H69:X=USR2(0)
4951 H=USR3(0)
4999 CLS:PRINT@460,"YOU HAVE LEFT THE PROGRAM.":END
5000 CLS:PRINT@468,"**** INPUT ERROR **** "
```

```
5001 '
5002 '
5010 PRINT@70."MAKE SURE WHAT YOU ENTER STARTED WITH A LETTER
     IF YOU ARE ANSWERING YOUR NAME OR CLASS."
5020 PRINT "  MAKE SURE YOU ONLY ENTER A NUMBER FOR MENU
     SELECTIONS."
5030 RESUME
7000 CLS:VM= 15360
7010 PRINTCHR$(23):PRINT@394,"ARCHITECHTURAL DETAILS "
7020 PRINT@532,"KITCHEN "
7030 CNT=0:CHAR=146
7040 FOR G = 194 TO 250
7050 POKE VM+ G,CHAR:NEXT G
7060 FOR H =  770 TO826
7070 POKE VM+H,CHAR:NEXTH
7080 FOR I = 194 TO 770 STEP 64
7090 POKE VM+I,CHAR:NEXT I
7100 FOR J = 250 TO 826 STEP 64
7110 POKE VM+J,CHAR: NEXTJ
7120 IF CNT=2 THEN 7150
7130 CNT=CNT+1:CHAR = CHAR + 10
7140 FOR T = 1 TO100:GOTO7040
7150 FOR T = 1 TO 1000:RETURN
7200 RETURN
7999 '
8000 ' PLOTTER SET UP ROUTINE **********************
8010 '
8020 DEFUSR1 = &H5A
8030 POKE 16890,&HFF   ' *** WAIT ***
8040 BR = 10          'SET BAUD RATE AT 2400 ******
8050 POKE 16888,(16*BR)+BR
8060 POKE 16889,127
8070 X=USR1(0)
8080 DEFUSR0=&H006C
8090 POKE &H4220,82
8100 POKE &H4221,79   ' *** R0 IS RS 232 OUTPUT ***
8110 POKE &H4222,80
8120 POKE &H4223,82
8130 X=USR0(0)
8140 DEFUSR3 = &H0053
8150 ' ***** DRAW INITIAL OUTLINE *****
8170 '
8180 LPRINT" ;:: P1 L0  HAD 1850,0 1850,1400 0,1400 0,0 0,100
     1850,100 U 50,30 ": CHR$(94)
8190 LPRINT "  S12 NAME: " ;" " ";FIR$ ; " "; LN$ ;CHR$(95)
8191 LPRINT" ;: A 500,30 ";CHR$(94)
8192 LPRINT " :: S12 CLASS:  " ; " ";CL$;CHR$(95)
8193 LPRINT" :: A 925,30"; CHR$(94)
8194 LPRINT " S12 SCHOOL: ";" ": SC$;CHR$(95)
8195 LPRINT " :: A 1600,30 ";CHR$(94)
8196 LPRINT ":: S12 ";" ";DA$;CHR$(95)
8198 LPRINT ":: P1 HAU 100,400 O R ";CHR$(94)
8999 RETURN
9000 '
9010 ' ************* JUMP ROUTINE *************
```

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```
9020 '
9030 '   *** THIS SECTION DECIDES WHERE TO GO TO DRAW
        THE CABINET REQUESTED.
9035 IF TY=1 OR TY = 5 THEN GOSUB 1000
9040 IF TY = 14 THEN GOSUB 13000
9045 IF TY = 2 OR TY = 3 THEN GOSUB 13500
9050 IF TY = 15 OR TY = 16 THEN GOSUB 13800
9055 IF TY = 10 OR TY = 9 THEN GOSUB 13900
9060 IF TY = 22 THEN GOSUB 14000
9065 IF TY = 8 THEN 14200
9070 IF TY = 6 OR TY = 7 OR TY = 4 THEN GOSUB 14500
9075 IF TY = 18 OR TY = 17 OR TY = 20 THEN GOSUB 15000
9080 IF TY = 13 THEN GOSUB 16000
9085 IF TY = 12 OR TY = 11 THEN GOSUB 16100
9090 IF TY = 21 THEN GOSUB 16300
9095 IF TY = 19 THEN GOSUB 16500
9998 RETURN
12000 ' ********  27 INCH BASE  *********
12005 '
12007 LPRINT ";: RD 225,0 O U 0,144 D L3 -225,0 U L0 A 0,0 R "
12010 LPRINT " ;: D 0,288 -225,0 0,-288 0,33 225,0 U 0,267 D -225,
      0 U 0,-300 4,37 D 105,0 0,191 -105,0 0, 191 U 112,0 D 105,0
      0,191
-105,0 0,-191 U -112,197 D 217,0 0,50 -217,0 0,-50 U 108,25 D CC
      0,4 U -23,-64 D CC 0,4 U 47,0 D CC 0,4 U -136,-195 "
12012 LPRINT " 20,-60 S12 B. 27 ";CHR$(95)
12014 LPRINT " U A 0,0 "
12015 GOTO 430
12050 '
13000 '
13005 ' *************** WALL CABINET ROUTINE **********
13010 '
13015 GOSUB 944
13020 X=0 :Y=INT(84*S): GOSUB 900
13025 GOSUB 934
13030 XW= INT (S*WY)
13035 YW = INT(S*HT)
13040 X = XW:Y = 0:GOSUB 900: GOSUB 934
13045 X=0 : Y = -YW: GOSUB 900
13050 X = -XW: Y = 0: GOSUB 900
13055 X = 0 : Y = YW: GOSUB 900
13060 GOSUB 944 '                               ' PICK UP PEN
13065 X = 4: Y = -4 '
13070 IF WY> 24 THEN 13195
13071 '
13072 '   *****ONE DOOR ROUTINE ****
13073 '
13075 XW = XW - 8 :YW = YW -8:GOSUB 900: GOSUB 934 'PEN DOWN
13080 X = XW: Y = 0: GOSUB 900
13085 X = 0 : Y = -YW: GOSUB 900
13090 X = -XW: Y = 0: GOSUB 900
13095 X = 0: Y = YW : GOSUB 900
13100 GOSUB 944 '                                    PEN UP
13105 CLS: PRINT "DO YOU WANT THE KNOB ON THE LEFT (L) OR THE
      RIGHT(R) OF THE CABINET ?"
13110 K$= INKEY$:IF K$= "" THEN 13110
13115 IF K$ = "R" THEN 13135
13120 '                         LEFT KNOB
```

```
13125 X = 20 :Y = -YW + 20 :GOSUB 900: GOSUB 974:GOSUB 944
13130 GOSUB 964: GOTO 13150
13135 '                            RIGHT KNOB
13140 X = XW - 20: Y = -YW + 20: GOSUB 900: GOSUB 974:GOSUB 944
13145 GOSUB 964
13150 IF HT < 20 THEN 13325 '     GOTO LABEL ROUTINE
13155 X = 0 : Y = -INT( HT/2*S)
13156 IF HT <30 THEN 13164
13157 X=0:Y=-INT(HT/3*S): GOSUB 900: GOSUB 934
13158 LPRINT " :: L3 "
13159 X=-(XW+8):Y=0: GOSUB 900:GOSUB 944
13160 X=XW+8:Y=0: GOSUB 900
13161 X=0:Y=-INT(HT/3*S)
13164 GOSUB 900:GOSUB 934
13165 LPRINT " :: L3"
13170 X = -(XW+8): Y = 0: GOSUB 900
13175 GOSUB 944
13180 LPRINT "L0 A 0,0 R U"
13185 GOTO 13325 '     GOTO LABEL ROUTINE
13190 '
13195 ' **** TWO DOOR ROUTINE ****
13197 '
13200 GOSUB 900: GOSUB 934: YW = YW - 8
13205 DWI = INT(((S*WY)-14)/2)
13210 X = DWI: Y = 0: GOSUB 900
13215 X = 0: Y = -YW : GOSUB 900
13220 X = -DWI: Y = 0:GOSUB 900
13225 X = 0 :Y = +YW: GOSUB 900: GOSUB 944
13230 X = DWI + 6: Y = 0: GOSUB 900
13235 GOSUB 934: X = DWI: Y = 0: GOSUB 900
13240 X = 0: Y = -YW: GOSUB 900
13245 X = -DWI: Y = 0: GOSUB 900
13250 X = 0: Y = YW: GOSUB 900
13255 GOSUB 944: X = 20: Y = -YW+20 :GOSUB 900
13260 GOSUB 974:GOSUB 944 '        DRAW RIGHT KNOB
13265 X = -46: Y = 0: GOSUB 900
13270 GOSUB 974: GOSUB 944: GOSUB 964:GOSUB 944
13271 X=0:Y=-HT*S: GOSUB 900
13272 IF HT < 20 THEN 13325
13275  IF HT < 30 THEN 13284
13276 FOR P = 1 TO 2
13277 X=0: Y=INT(HT/3*S):GOSUB 900
13278 GOSUB 934
13279 LPRINT " ::L3 "
13280 X=-(XW): Y=0: GOSUB 900
13281 GOSUB 944:X=XW:Y=0:GOSUB 900:NEXT P
13282 LPRINT "L0 A 0,0 R U"
13283 GOTO 13325
13284 X=0: Y=INT(HT/2*S): GOSUB 900
13285 GOSUB 934
13300 LPRINT ":: L3"
13305 X = -(XW): Y = 0: GOSUB 900
13310 LPRINT "L0 U A 0,0 R "
13320 '
13324 GOSUB 964
13325 ' ****LABEL ROUTINE *****
13327 GOSUB 964: IF 1Y = 13 THEN RETURN
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```
13328 X=-XW-10:IF TY=16 THEN X=X-80
13329 IF WY = 12 THEN X = X-20
13330 Y = -300 :GOSUB 900
13332 WL$ = "W."
13334 IF TY = 15 THEN WL$ = "B.R.W."
13335 IF TY = 15 OR TY = 16 THEN WY = WY + 12
13336 IF TY = 16 THEN WL$ = "B.L.W."
13337 IF TY = 13 THEN WL$=" W/H"
13340 LPRINT "  :: S11 "; WL$;CHR$(94)
13342 LPRINT STR$(HT)+STR$(WY); CHR$(95)
13345 GOSUB 944: GOSUB 964
13350 X = 0: Y =-INT(84*S):GOSUB 900
13370 RETURN
13500 '
13505 ' **** BLIND RIGHT AND LEFT BASE ROUTINES ***
13510 '
13520 WY = WY - 24
13525 IF TY = 3 THEN 13540
13530 GOSUB 1000 '                DRAW WY-24 BASE
13535 '            BLIND RIGHT
13538 '
13540 GOSUB 964:XW = INT(24*S): YH = 288: GOSUB 934
13545 X = XW : Y = 0: GOSUB 900
13550  GOSUB 954
13555 X = 0: Y = YH :GOSUB 900
13560 X = -XW: Y = 0: GOSUB 900
13565 X = 0 : Y = -YH : GOSUB 900
13570 X = 0 :Y = 33 : GOSUB 900
13575 IF TY = 3 OR TY = 12 THEN 13635
13580 '
13585 X = 33:Y = 0: GOSUB 900
13590 LPRINT ":: L3 "
13595 X= (XW-33): Y =0: GOSUB 900
13600 LPRINT" :: L0 U "
13605 X = -(XW-33):Y = 0: GOSUB 900
13610 GOSUB 934
13615 X = 0:Y = -33:GOSUB 900
13620 X = 0 :Y= 33: GOSUB 900: X=(XW-33):Y=255:GOSUB 900
13625 X = -XW: Y = 0: GOSUB 900: X = XW: Y = -255: GOSUB 900
      900:GOSUB 944:GOSUB 964: GOTO 13750
13630 GOSUB 944: X=0:Y=267:GOSUB 900: GOSUB 934:X=-XW:Y=0:GOSUB
13635 '            BLIND LEFT
13637 GOSUB 934:X=(XW-33): Y = 0: GOSUB 900
13640 LPRINT ":: L3 "
13645 GOSUB 934:X = 33: Y = 0: GOSUB 900
13650 LPRINT ":: L0 U "
13655 X = 33: Y=0:GOSUB 900
13660 GOSUB 934
13665 X=0: Y=-33: GOSUB 900
13670 GOSUB 944
13675 X=33: Y=33: GOSUB 900
13680 GOSUB 934
13685 X=-(XW):Y=255:GOSUB 900
13690 X=XW:Y=0:GOSUB 900
13695 X=-(XW):Y=-255:GOSUB 900: GOSUB 944
13697 X=0:Y=268:GOSUB 900:GOSUB 934
13698 X=XW:Y=0:GOSUB 900
13700 GOSUB 944: GOSUB 964
13702 IF TY = 12 THEN 13750
```

```
13705 GOSUB 1000:GOSUB 964
13750 X = -INT((WY+24)*S-40) : Y = -63:IF TY = 12 THEN X=X+50
13753 GOSUB 900
13755 BL$="B.L. "
13760 IF TY = 3 THEN BL$ = "B.R. "
13761 IF TY = 11 THEN BL$="R.C.B. RT."
13762 IF TY = 12 THEN BL$="R.C.B. LT."
13765 LPRINT ":: S12 ";+BL$
13770 LPRINT  STR$(WY+24);CHR$(95)
13775 GOSUB 964
13777 IF TY = 12 THEN 16125
13780 LPRINT "U A 0,0"
13785 RETURN
13800 '
13805 ' ******* BLIND LEFT AND RIGHT WALL ROUTINES ****
13810 '
13815 WW = INT(12*S): WH= INT(HT * S):WY = WY - 12
13820 IF TY = 16 THEN 13827
13825 GOSUB 13000 '   DRAW (WY-12) WALL CABINET ***********
13827 X=0 :Y=INT(84*S) : GOSUB 900
13830 GOSUB 934:X = WW: Y = 0: GOSUB 900
13835 X = 0: Y = -WH: GOSUB 900
13840 X = -WW: Y =0 :GOSUB 900
13845 X = 0: Y = WH: GOSUB 900
13850 X = WW: Y = -WH: GOSUB 900
13855 X = -WW: Y = 0: GOSUB 900
13860 X = WW: Y = WH: GOSUB 900
13865 GOSUB 954: GOSUB 944
13866 X=0: Y=-INT(84*S): GOSUB 900
13867 IF TY = 15 THEN RETURN
13870 IF TY = 16 THEN GOSUB 13000
13873 IF TY = 16 THEN RETURN
13874 IF TY = 12 THEN 16125
13875 X=0:Y=-INT(84*S): GOSUB 900: GOSUB 954
13880 RETURN
13900 '
13905 '    ********* TRAY STORAGE AND TOWEL DRYER ROUTINES ****
13910 '
13915 GOSUB 1000
13920 LB$="TD"
13922 X=-30 : Y=0: GOSUB 900
13925 IF TY = 9 THEN LB$= "BT"
13930 LPRINT ";: S12 ";+LB$
13935 LPRINT STR$(WY);CHR$ (95)
13940 GOSUB 964
13945 IF TY = 10 THEN 13970
13950 X = -INT(WID/2): Y = 33 : GOSUB 900
13955 GOSUB 934
13960 LPRINT ";: L3 "
13965 X = 0 : Y = 191: GOSUB 900: GOSUB 944
13970 LPRINT ";: L0 A 0,0 RU "
13975 RETURN
14000 '
14005 ' *******  MANUAL PLOT ROUTINE  *******
14010 '
14015 CLS: PRINT@73," MANUEL CONTROL COMMANDS ": PRINT
14020 PRINT " UP ARROW ................MOVE UP "
14025 PRINT " DOWN ARROW ...........MOVE DOWN "
```

```
14030 PRINT " LEFT ARROW ............MOVE LEFT "
14035 PRINT " RIGHT ARROW .........MOVE RIGHT "
14040 PRINT " P & UP ARROW ............PEN UP "
14045 PRINT " P & DOWN ARROW ........PEN DOWN "
14050 PRINT " LEFT AND DOWN ARROW........HOME "
14055 PRINT " LEFT AND RIGHT ARROW.......TEST "
14060 PRINT " R ................RETURN TO MENU "
14065 '
14070 C$=";: R ":GOSUB 850
14075 L=PEEK(14420)
14080 IF L = 64 THEN C$ = "12 0 " :GOSUB 850
14085 IF L = 32 THEN C$ = "-12 0 " : GOSUB 850
14090 IF L = 8 THEN C$ = " 0 12 ": GOSUB 850
14095 IF L = 16 THEN C$  = " 0 -12": GOSUB 850
14100 IF L = 9 THEN C$ = "U ":GOSUB 850
14105 IF L = 17 THEN C$ = "D" : GOSUB 850
14110 IF L = 48 THEN C$ = " H " : GOSUB 850
14115 IF L = 96 THEN C$ = " T": GOSUB 850
14120 IF L <>4 THEN 14070
14150 RETURN
14200 '
14205 ' ********* RANGE ROUTINES ******
14210 '
14215 GOSUB 1000
14220 TR$= "R "
14225 LPRINT ";: S12 ";+TR$
14230 LPRINT STR$(WY);CHR$(95)
14235 GOSUB 964
14240 LPRINT "UA 0.0"
14245 RETURN
14500 '
14510 ' **** 4 DRAWER BASE, DISHWASHER, AND COMPACTOR ****
14520 '
14540 IF TY = 7 THEN 14700
14550 IF TY = 4 THEN 14800
14560 ' *** DISHWASHER ***
14562 '
14563 WID = INT(S*24):WY = 24: GOSUB 1000
14564  WID=WID-8:GOSUB 944: X = -4:Y = 60: GOSUB 900: GOSUB 934
14566 X = WID+8: Y = 0 : GOSUB 900: GOSUB 944
14568 X = -4:Y = 4: GOSUB 900: GOSUB 934
14570 Y = 185: X = 0: GOSUB 900
14572 X = -WID: Y = 0: GOSUB 900
14574 X = 0: Y =-185: GOSUB 900
14576 X = WID: Y = 0: GOSUB 900: GOSUB 944
14578 X=-INT((WID/2)+25): Y = 165: GOSUB 900
14580 GOSUB 934:X = 50: Y=0: GOSUB 900
14582 X = 0: Y = 2: GOSUB 900
14584 X = -50: Y = 0: GOSUB 900
14586 X = 0: Y = -2: GOSUB 900
14588 GOSUB 944: X = INT(WID/2): Y = -30: GOSUB 900
14590 LPRINT ";: CC 0,12 "
14592 GOSUB 944: GOSUB 964
14594 GOTO 14947
14700 '
14701 ' *** TRASH COMPACTOR ***
14702 '
14703 CLS:PRINT " A TRASH COMPACTOR CAN BE 15 OR 24 INCHES WIDE.
      ENTER THE WIDTH YOU PREFER. ": INPUT WY: GOSUB 1000
```

```
14704 WID = INT ( WY * S )
14706 WID = WID - 8: GOSUB 934
14708 X = WID: Y = 0 : GOSUB 900
14710 X = 0: Y = 184: GOSUB 900
14712 X = -WID: Y = 0 : GOSUB 900
14714 X = 0: Y = -184 : GOSUB 900
14716 GOSUB 944: Y = 190: X = -4 : GOSUB 900
14718 GOSUB 934: X = WID+4: Y = 0:  GOSUB 900
14720 GOSUB 944: Y = 25: X = -25: GOSUB 900
14722 LPRINT ";: CC 0,12 "
14724 GOSUB 944: X = -INT((WID/2)):Y = -50: GOSUB 900
14726 GOSUB 934: X = 50:Y = 0 :GOSUB 900
14728 X = 0: Y = 2:GOSUB 900
14730 X = -50 : Y = 0: GOSUB 900
14732 X = 0:Y = -2: GOSUB 900
14734 GOSUB 944: GOSUB 964
14736 GOTO 14947
14800 ' 4 DRAWER BASE **
14805 '
14807 GOSUB 1000
14810 WID = WID - 8 :GOSUB 934
14815 X = WID: Y = 0 : GOSUB 900
14820 X = 0: Y = 70:GOSUB 900
14825 X = -WID: Y = 0 : GOSUB 900
14830 X = 0 : Y = -70 :GOSUB 900
14835 GOSUB 944: X = 0 : Y = 74: GOSUB 900
14840 GOSUB 934: X = WID: Y = 0 : GOSUB 900
14845 X = 0 : Y = 65: GOSUB 900
14850 X = -WID: Y = 0 : GOSUB 900
14855 X = 0 : Y = -65: GOSUB 900
14860 GOSUB 944: X = 0: Y = 69: GOSUB 900
14865 GOSUB 934: X = WID: Y = 0 : GOSUB 900
14870 X = 0 : Y = 50: GOSUB 900
14875 X = -WID: Y = 0: GOSUB 900
14880 X = 0: Y = -50 : GOSUB 900
14885 GOSUB 944: X = 0: Y = 54: GOSUB 900:GOSUB 934
14890 X = WID: Y = 0 : GOSUB 900
14895 X = 0: Y = 50 : GOSUB 900
14900 X = -WID : Y = 0 : GOSUB 900
14905 X = 0 : Y = -50 : GOSUB 900
14910 GOSUB 944: X = INT(WID/2):Y = 25: GOSUB 900
14915 GOSUB 974: GOSUB 944
14920 Y = -54: X = 0 : GOSUB 900
14925 GOSUB 974: GOSUB 944
14930 Y = -61: X = 0: GOSUB 900
14935 GOSUB 974: GOSUB 944
14940 Y = -72: X = 0 :GOSUB 900
14945 GOSUB 974: GOSUB 944: GOSUB 964
14947 X=-WID: Y=-60: GOSUB 900
14950 DD$ = "B 4D"
14952 IF TY = 6 THEN DD$ = " DW "
14954 IF TY = 7 THEN DD$ = " TC "
14956 LPRINT ";: S12"; + DD$
14958 LPRINT STR$(WY);CHR$(95)
14960 GOSUB  964
14962 LPRINT "U A 0.0"
14964 RETURN
15000 '
15005 ' ****** OVEN AND STORAGE ROUTINES ****
```

```
15010 '
15015 OF = 0
15020 OW = INT(S*WY):OH=INT(84*S):GOSUB 934
15025 X=OW: Y=0: GOSUB 900: GOSUB 954
15030 X=0: Y=OH: GOSUB 900
15035 X=-OW: Y=0: GOSUB 900
15040 X=0: Y=-OH: GOSUB 900: GOSUB 944
15045 X=0: Y=33: GOSUB 900: GOSUB 934
15050 X=OW: Y=0: GOSUB 900: GOSUB 944
15055 IF TY= 20 THEN 15700 ' GO TO STORAGE ROUTINE ****
15060 IF WY<33 THEN GOTO 15500 '  GOTO ONE DOOR ROUTINE ***
15065 '
15070 ' ** 2 DOOR ROUTINE **
15075 '
15080 DW=INT((OW-14)/2)
15085 X=-4:Y=4:GOSUB 900: GOSUB 934
15090 DH=234: IF TY = 18 THEN DH=164
15095 X=0: Y=DH: GOSUB 900
15100 X=-DW: Y=0: GOSUB 900
15105 X=0: Y=-DH: GOSUB 900
15110 X=DW: Y=0: GOSUB 900: GOSUB 944
15115 X=-DW-6: Y=0:GOSUB 900: GOSUB 934
15120 X=0: Y=DH: GOSUB 900
15125 X=-DW: Y=0: GOSUB 900
15130 X=0: Y=-DH: GOSUB 900
15135 X=DW: Y=0: GOSUB 900: GOSUB 944
15140 X=-20: Y=DH-20: GOSUB 900: GOSUB 974: GOSUB 944
15145 X=46: Y=0: GOSUB 900: GOSUB 974: GOSUB 944
15150 X=-(26+DW): Y=35: GOSUB 900
15155 DH=200: IF TY=18 THEN DH = 175
15157 X=0: Y=4: GOSUB 900
15160 OD=OW-8: OF = OF + 1: GOSUB 934
15165 X=OD: Y=0: GOSUB 900
15170 X=0: Y=DH: GOSUB 900
15175 X=-OD: Y=0: GOSUB 900
15180 X=0: Y=-DH: GOSUB 900
15185 GOSUB 944
15190 GH=DH-30: GW=OD-B
15195 X=4: Y=4: GOSUB 900: GOSUB 934
15200 X=GW: Y=0: GOSUB 900
15205 X=0: Y=GH: GOSUB 900
15210 X=-GW: Y=0 :GOSUB 900
15215 X=0: Y=-GH: GOSUB 900: GOSUB 944
15220 X=INT((GW/2)-25): Y=GH-15: GOSUB 900: GOSUB 934
15225 X=50: Y=0: GOSUB 900
15230 X=0: Y=2: GOSUB 900
15235 X=-50: Y=0: GOSUB 900
15240 X=0: Y=-2: GOSUB 900
15245 GOSUB 944
15255 X=-INT(GW/2)+23: Y=60: GOSUB 900
15258 IF OF = 2 THEN 15270
15260 IF TY = 17 THEN 15270
15265 DH=125: IF OF < 2 THEN 15160
15270 GOSUB 944: GOSUB 964
15275 Y=501: X=-OW+4
15280 IF TY=18 THEN Y=546
15285 GOSUB 900
```

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```
15290 '               *****  TOP CABINETS ***
15295 DH= 195: IF TY = 18 THEN DH=150
15300 GOSUB 934: X=DW: Y=0: GOSUB 900
15305 X=0: Y=DH: GOSUB 900
15310 X=-DW: Y=0: GOSUB 900
15315 X=0: Y=-DH: GOSUB 900: GOSUB 944
15318 IF WY < 33 THEN 15600
15320 X=DW+6: Y=0: GOSUB 900: GOSUB 934
15325 X=DW: Y=0: GOSUB 900
15330 X=0:Y=DH: GOSUB 900
15335 X=-DW: Y=0: GOSUB 900
15340 X=0: Y=-DH: GOSUB 900: GOSUB 944
15345 X=20: Y=20  : GOSUB 900
15350 GOSUB 974: GOSUB 944
15355 X=-46: Y=0: GOSUB 900
15360 GOSUB 974: GOSUB 944
15365 GOSUB 964
15380 GOSUB 964
15385 GOTO 15850
15500 '
15505 ' ****  ONE DOOR OVEN CABINET ROUTINE  ****
15510 '
15515 DW=OW-8: DH=234
15520 IF TY = 18 THEN DH = 164
15525 X=-4: Y=4: GOSUB 900: GOSUB 934
15530 X=0:Y=DH: GOSUB 900
15535 X=-DW: Y=0: GOSUB 900
15540 X=0: Y=-DH: GOSUB 900
15545 X=DW: Y=0: GOSUB 900: GOSUB 944 ' FINISH LOWER DOOR
15550 CLS:PRINT "DO YOU WANT THE KNOBS ON THE LEFT (L) OR RIGHT
      (R) OF THE CABINET DOORS ? "
15555 K$ = INKEY$: IF K$ = "" THEN 15555
15557 IF TY = 20 THEN 15730
15560 IF K$ = "R" THEN 15575
15565 IF K$ = "L" THEN 15585
15570 GOTO 15555
15575 X=-20: Y=DH-20: GOSUB 900: GOSUB 974
15580 GOSUB 944: X=-(DW-20): Y=35: GOSUB 900: GOSUB 934:
      GOTO 15155
15585 X= (DW-20): Y=DH-20: GOSUB 900: GOSUB 974
15590 GOSUB 944: X=-20: Y=35: GOSUB 900: GOSUB 934
15595 GOTO 15155 '  ** GO DRAW OVEN DOORS **
15600 IF K$="R" THEN X=DW-20
15605 IF K$="L" THEN X=20
15610 Y=20: GOSUB 900: GOSUB 974: GOSUB 944
15615 IF K$ = "R" THEN X=20
15620 IF K$ = "L" THEN X=DW-20
15625 Y=DH-5: GOSUB 900
15630  GOSUB 944: GOSUB 964
15635 GOTO 15850
15700 '
15705 ' *** STORAGE ROUTINE ***
15710 '
15715 DW = OW - 8: DH = 500
15720 GOTO 15525 ' GO DRAW LOWER DOOR *****
15725 ' *
15730 IF K$ = "R" THEN 15745
15735 IF K$ = "L" THEN 15755
```

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```
15740 GOTO 15555
15745 X=-20: Y=400: GOSUB 900: GOSUB 974: GOSUB 944
15750 X=-DW+20: Y=106: GOSUB 900: GOSUB 934: GOTO 15755
15751 X=-DW+20: Y=400: GOSUB 900: GOSUB 974: GOSUB 944
15753 X=-20: Y=106: GOSUB 900: GOSUB 934
15755 X=DW: Y=0 : GOSUB 900
15760 X=0: Y=153: GOSUB 900
15765 X=-DW: Y=0: GOSUB 900
15770 X=0: Y=-153: GOSUB 900
15775 IF K$ = "1" THEN 15790
15780 X=DW-20: Y=20: GOSUB 944: GOSUB 900
15785 GOSUB 974: GOSUB 944: X=20: Y=152: GOSUB 900: GOTO 15800
15790 X=20: Y=20: GOSUB 944: GOSUB 900
15795 GOSUB 974: GOSUB 944: X=DW-20: Y=152: GOSUB 900
15800 GOSUB 944: GOSUB 964
15849 '
15850 ' OVEN AND STORAGE LABEL ROUTINE
15855 '
15860 X=-DW: Y=-65: GOSUB 900
15865 LB$ = " O."
15870 IF TY =10 THEN LB$ = " DBL.O."
15875 IF TY = 20 THEN LB$ = " ST."
15880 LPRINT ";: S12";+LB$
15885 LPRINT STR$(WY);CHR$(95)
15890 GOSUB 964
15895 LPRINT "U A 0,0"
15900 RETURN
16000 '
16005 ' *** WALL CABINET WITH HOOD  ***
16010 '
16015 HT=12: GOSUB 13015
16020 GOSUB 944: X=0: Y = -YW-5: GOSUB 900
16025 GOSUB 934
16030 X=0: Y=-60: GOSUB 900
16035 X=-XW: Y=0: GOSUB 900
16040 X=0: Y=60: GOSUB 900
16045 X=30: Y=-35: GOSUB 900
16050 X=0: Y=-25: GOSUB 900
16055 X=0: Y=25 : GOSUB 900
16060 X=XW-60: Y=0: GOSUB 900
16065 X=0: Y=-25: GOSUB 900
16070 X=0: Y=25: GOSUB 900
16075 X=30: Y=35: GOSUB 900: GOSUB 944: GOSUB 964
16078 GOSUB 13328
16085 RETURN
16100 '
16105 ' **** ROTATING CORNER BASE CABINETS ****
16110 '
16115 WY=WY-24
16120 IF TY = 12 THEN 13540
16125 XW=INT(12*5): XH=288: GOSUB 934
16130 X=XW: Y=0: GOSUB 900
16135 GOSUB 954
16140 X=0: Y=XH: GOSUB 900
16145 X=-XW: Y=0 : GOSUB 900
16150 X=0: Y=-XH: GOSUB 900: GOSUB 944
16155 X=0: Y=300: GOSUB 900: GOSUB 934
```

```
16160 X=XW: Y=0: GOSUB 900: GOSUB 944: GOSUB 964
16165 X=0: Y=33: GOSUB 900: GOSUB 934
16170 X= XW: Y=0: GOSUB 900: GOSUB 944
16175 X=4: Y=4: GOSUB 900: GOSUB 934
16180 XW=XW-8: XH=XH-41
16185 X=XW: Y= 0: GOSUB 900
16190 X=0: Y=XH: GOSUB 900
16195 X=-XW: Y=0: GOSUB 900
16200 X=0: Y=-XH: GOSUB 900: GOSUB 944
16205 X=20: Y=195  : IF TY = 12 THEN X = XW-20
16210 GOSUB 900: GOSUB 974: GOSUB 944: GOSUB 964
16215 IF TY = 12 THEN RETURN
16220 GOTO 13540
16300 '
16305 ' **** DESK ROUTINE ****
16310 '
16315 DW=298: DH=INT(WY*S)
16320 X=0 :Y=DW: GOSUB 934 : GOSUB 900
16325 X=DH: Y=0: GOSUB 900
16326 GOSUB 944: X=0:Y=12: GOSUB 900: GOSUB 934: X=-DH: Y=0:
      GOSUB 900: GOSUB 944:X=DH: Y=-12:GOSUB 900: GOSUB 934
16330 X=0: Y=-62: GOSUB 900
16335 X=-DH: Y=0: GOSUB 900: GOSUB 944
16340 X=6: Y=6: GOSUB 900: GOSUB 934
16345 DR=DH-12: DU=50
16350 X=0: Y=DU: GOSUB 900
16355 X=DR: Y=0:GOSUB 900
16360 X=0: Y=-DU: GOSUB 900
16365 X=-DR: Y=0: GOSUB 900: GOSUB 944
16370 X=INT(DR/2): Y=25: GOSUB 900
16375 GOSUB 974: GOSUB 944
16380 X=-INT(DR/2): Y=-31: GOSUB 900: GOSUB 934
16385 X=0: Y=-(DW-62): GOSUB 900
16390 X=-6: Y=0 : GOSUB 900: GOSUB 944
16395 X=DH-8: Y=0: GOSUB 900: GOSUB 934
16400 X=0: Y=DW-62: GOSUB 900
16405 X=6: Y=0: GOSUB 900
16410 X=0: Y=-(DW-62): GOSUB 900: GOSUB 954
16415 X=-6: Y=0: GOSUB 900: GOSUB 944
16420 X=-(DH-20): Y=-63: GOSUB 900
16425 BL$=" DESK"
16430 LPRINT" ;: S12";BL$
16435 LPRINT STR$(WY);CHR$(95)
16440 GOSUB 944: GOSUB 964
16445 RETURN
16500 '
16505 ' ****  FURRED CEILING  ****
16510 '
16515 GOSUB 944
16517 LPRINT" ;: A H 100.400 R "
16520 X = 0: Y = 712
16522 XS = INT ( XX * S )
16525 GOSUB 900: GOSUB 934
16530 X = XS: Y = 0: GOSUB 900
16535 GOSUB 944: GOSUB 964
16540 RETURN
```

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```
                 S T A I R   C A L C U L A T O R

   FLOOR TO FLOOR DISTANCE IN INCHES ........... ? 98
   STAIR RUN IN INCHES ......................... ? 124
   ENTER NUMBER OF RISERS DESIRED ............. [illegible] 13
   NO. OF TREADS (ALWAYS 1 LESS THAN RISERS)... [illegible]2


         RISER HEIGHT = ............................ 7.53846    INCHES
         TREAD WIDTH = ............................. 10.3333    INCHES
                                                   ---------------

           RISER + TREAD EQUAL ..............      17.8718    INCHES


  THE COMBINED RISE AND RUN SHOULD BE AS CLOSE TO  17.5  INCHES
  AS POSSIBLE.

    DO YOU WANT ANOTHER CALCULATION ? (1=YES, 2=NO)? ^C
Break in 250
Ready
>SYSTEM"SCREEN
```

```
10 CLS
20 PRINT"                  S T A I R   C A L C U L A T O R"
30 PRINT
40 REM                      MYCUE  -  1983
50 PRINT
60 INPUT"  FLOOR TO FLOOR DISTANCE IN INCHES ........... ";F
70 INPUT"  STAIR RUN IN INCHES ......................... ";R
80 INPUT"  ENTER NUMBER OF RISERS DESIRED .............  ";NR
90 INPUT"  NO. OF TREADS (ALWAYS 1 LESS THAN RISERS).... ";NT
100 TW=R/NT      'TREAD WIDTH=RUN/NO. OF TREADS
110 RI=F/NR      'RISER HEIGHT=FLOOR TO FLOOR HT./NO. OF RISERS
120 R=NT*TW      'RUN=NO. OF TREADS TIMES TREAD WIDTH
130 RT=RI+TW     'RISER HEIGHT + TREAD WIDTH
140 PRINT:PRINT
150 PRINT"       RISER HEIGHT = ...........................";RI;"   INCHES
160 PRINT"       TREAD WIDTH = ............................";TW;"   INCHES
170 PRINT"                                                            "
180 PRINT                                                ---------------
190 PRINT"         RISER + TREAD EQUAL ..............      ";RT;"   INCHES
200 PRINT
210 PRINT
220 PRINT" THE COMBINED RISE AND RUN SHOULD BE AS CLOSE TO  17.5  INCHES
230 PRINT" AS POSSIBLE.
240 PRINT
250 INPUT"   DO YOU WANT ANOTHER CALCULATION ? (1=YES, 2=NO)";FF
260 IF FF=1 THEN 10
270 IF FF=2 THEN END
```

APPLYCATIONS

This is a set of applycation programs. That is programs meant to be used to perform a certain task. The first program of this group is "ROOF". This program will estimate the cost, joist, rafters, and the plywood decking for a roof. With prices from a catalog it could easily be updated to calculate shingles, and paper. The program prints out a cutting chart, a buying chart, and a total cost. For instance, say you wanted to build a roof with a 24' 0" top plate at the eave, and a 24' 0" span. With a 24" overhang at the eave and a 12" overhang of the rake. That has 6" rise per foot of run, a 6" thick ridgeboard, a 2.5" thick 5.5" wide rafter, and a 16" spacing between the rafters and between the joist. With a price of $184.00 per 1000 board feet, and $12.00 each for 4' by 8' plywood. This program could give you a cutting chart for the joist, rafters, and plywood. Plus a price list for the same, and a total cost. The number of squares in the roof are also already computed in case you want to add shingles to the program.

Here is a sample run and listing of the program.

```
RUN ROOF



     THIS PROGRAM WILL HELP YOU
ESTIMATE THE COST AND MATERIAL OF
A GIVEN ROOF.
          DEMONSTRATION PROGRAM
         FOR EDUCATIONAL USE ONLY



     PRESS <RETURN> TO CONTINUE?



     TO RUN THIS PROGRAM YOU NEED
TO KNOW THE LENGTH OF THE TOP PLATE
AT THE EAVE, THE SPAN OF THE ROOF,
THE OVERHANG OF THE RAKE, THE RISE
PER FOOT OF RUN, THE ACTUAL SIZE OF
THE RIDGEBOARD, THE SIZE OF THE
RAFTERS(THICKNESS AND WIDTH), THE
SPACING OF THE RAFTERS, THE SPACING
OF THE JOIST, AND THE PRICE PER 1000
BOARD FEET.



     DO YOU HAVE THESE (Y/N)?


     WHAT IS THE LENGTH OF THE TOP
PLATE, AT THE EAVE, IN FEET AND INCHES
                        FEET?24
                        INCHES?0



     WHAT IS THE SPAN OF THE ROOF IN
FEET AND INCHES
                        FEET?24
                        INCHES?0



     WHAT IS THE OVERHANG OF THE EAVE
IN INCHES?24



     WHAT IS THE OVERHANG OF THE RAKE
IN INCHES?12



     WHAT IS THE RISE PER FOOT OF
RUN, IN INCHES?6
```

```
    WHAT IS THE ACTUAL SIZE OF THE
RIDGEBOARD THICKNESS IN INCHES?6


    WHAT IS THE SIZE OF THE RAFTER
IN INCHES
                   THICKNESS?2.5
                   WIDTH?5.5


    WHAT IS THE SPACING OF THE
RAFTERS IN INCHES?16


    WHAT IS THE SPACING OF THE JOIST
IN INCHES?16


    WHAT IS THE PRICE PER 1000 BOARD
FEET?184


    WHAT IS THE COST OF A 4' BY 8'
SHEET OF PLYWOOD?12
    DO YOU WANT THE OUTPUT TO GO
TO THE PRINTER (Y/N)?SET THE PRINTER TO THE TOP OF


PRESS <RETURN> TO CONTINUE?
             CUTTING CHART

      ITEM              QUANTITY LENGTH
      RAFTERS           38       15 FT. 7.22 IN.
      JOIST             19       22 FT. 10.99 IN.
      RIDGEBOARDS       1        26 FT. 0 IN.
      FASCIAL BOARDS 2           26 FT. 0 IN.
      PLYWOOD SHEETS 28          8 FT. BY 4 FT.


         MATERIAL AND COST CHART

      ITEM              QUANTITY LENGTH COST
      RAFTERS           38       16 FT. $111.87
      JOIST             19       24 FT. $83.9
      RIDGEBOARDS       1        26 FT. $4.79
      FASCIAL BOARDS 2           26 FT. $9.56
      PLYWOOD SHEETS 28          4'X8'  $336

      TOTAL COST: 546.12
```

```
]LIST

10  REM THIS IS A PROGRAM
20  REM TO ESTIMATE THE COST
30  REM AND MATERIAL OF A
40  REM ROOFING PROJECT
50  REM
55  HOME : PRINT : PRINT : PRINT

60  PRINT  TAB( 5)"THIS PROGRAM W
     ILL HELP YOU"
70  PRINT "ESTIMATE THE COST AND
     MATERIAL OF"
80  PRINT "A GIVEN ROOF."
81  VTAB 10
82  INVERSE
83  HTAB 10: PRINT "DEMONSTRATION
      PROGRAM"
84  HTAB 9: PRINT "FOR EDUCATIONA
     L USE ONLY"
85  NORMAL
86  PRINT : PRINT : PRINT
87  PRINT  TAB( 5)"PRESS <RETURN>
      TO CONTINUE";: INPUT A$
90  HOME : PRINT : PRINT : PRINT

95  REM
100  PRINT  TAB( 5)"TO RUN THIS P
     ROGRAM YOU NEED"
110  PRINT "TO KNOW THE LENGTH OF
      THE TOP PLATE"
120  PRINT "AT THE EAVE, THE SPAN
      OF THE ROOF,"
130  PRINT "THE OVERHANG OF THE R
     AKE, THE RISE"
140  PRINT "PER FOOT OF RUN, THE
     ACTUAL SIZE OF"
150  PRINT "THE RIDGEBOARD, THE S
     IZE OF THE"
160  PRINT "RAFTERS(THICKNESS AND
      WIDTH), THE"
170  PRINT "SPACING OF THE RAFTER
     S, THE SPACING"
180  PRINT "OF THE JOIST, AND THE
      PRICE PER 1000"
190  PRINT "BOARD FEET."
200  PRINT : PRINT : PRINT
210  PRINT  TAB( 5)"DO YOU HAVE T
     HESE (Y/N)?";
220  GET X$
230  PRINT : PRINT : PRINT
240  IF X$ = "Y" GOTO 280
250  IF X$ = "N" THEN  END
260  PRINT  TAB( 5)"ILLEGAL ENTRY
     , TRY AGAIN.": PRINT : PRINT
     : PRINT
```

```
270  GOTO 210
280  REM
290  REM  ENTER THE DATA
300  REM
310  PRINT  TAB( 5)"WHAT IS THE L
     ENGTH OF THE TOP"
320  PRINT "PLATE, AT THE EAVE, I
     N FEET AND INCHES"
321  PRINT  TAB( 20)"FEET";: INPUT
     F
322  PRINT  TAB( 20)"INCHES";: INPUT
     I
323 I = I / 12
324 LP = F + I
330  PRINT : PRINT : PRINT
340  PRINT  TAB( 5)"WHAT IS THE S
     PAN OF THE ROOF IN"
341  PRINT "FEET AND INCHES"
342  PRINT  TAB( 20)"FEET";: INPUT
     F
343  PRINT  TAB( 20)"INCHES";: INPUT
     I
344 I = (I - 7) / 12
345 LS = F + I
350  PRINT : PRINT : PRINT
360  PRINT  TAB( 5)"WHAT IS THE O
     VERHANG OF THE EAVE"
361  PRINT "IN INCHES";: INPUT I
362 I = (I + 3.5) / 12
363 OE = I
370  PRINT : PRINT : PRINT
380  PRINT  TAB( 5)"WHAT IS THE O
     VERHANG OF THE RAKE"
381  PRINT "IN INCHES";: INPUT I
382 I = I / 12
383 OV = I
390  PRINT : PRINT : PRINT
400  PRINT  TAB( 5)"WHAT IS THE R
     ISE PER FOOT OF"
410  PRINT "RUN, IN INCHES";: INPUT
     I
420 I = I / 12
430 RI = I
440  PRINT : PRINT : PRINT
450  PRINT  TAB( 5)"WHAT IS THE A
     CTUAL SIZE OF THE"
460  PRINT "RIDGEBOARD THICKNESS
     IN INCHES";: INPUT I
470 I = I / 12
480 RT = I
485 LS = LS - RT
490  PRINT : PRINT : PRINT
500  PRINT  TAB( 5)"WHAT IS THE S
     IZE OF THE RAFTER"
501  PRINT "IN INCHES"
502  PRINT  TAB( 20)"THICKNESS";:
      INPUT TR
503 TR = TR / 12
```

```
504  PRINT  TAB( 20)"WIDTH";: INPUT
     WR
505 WR = WR / 12
580  PRINT : PRINT : PRINT
590  PRINT  TAB( 5)"WHAT IS THE S
     PACING OF THE"
600  PRINT "RAFTERS IN INCHES";: INPUT
     I
610 I = I / 12
620 SR = I
630  PRINT : PRINT : PRINT
640  PRINT  TAB( 5)"WHAT IS THE S
     PACING OF THE JOIST"
650  PRINT "IN INCHES";: INPUT I
660 I = I / 12
670 SJ = I
680  PRINT : PRINT : PRINT
690  PRINT  TAB( 5)"WHAT IS THE P
     RICE PER 1000 BOARD"
700  PRINT "FEET";: INPUT C
705 C = C / 1000
710  PRINT : PRINT : PRINT
711  PRINT  TAB( 5)"WHAT IS THE C
     OST OF A 4' BY 8'"
712  PRINT "SHEET OF PLYWOOD";: INPUT
     CP
720  REM
730  REM COMPUTE THE # OF RAFTERS

740  REM THERE COST AND WASTE
750  REM
755  REM FIND THE LENGTH
760 RL =  SQR ((.5 * LS) ^ 2 + (.
     5 * LS * RI) ^ 2)
770 RL = RL +  SQR (OE ^ 2 + (RI *
     OE) ^ 2)
780 RL = RL + (WR * RI)
784  REM
785  REM FIND THE # OF FEET
786  REM
790 R1 =  INT (RL)
794  REM
795  REM FIND THE # OF INCHES
796  REM
800 R2 = RL -  INT (RL)
810 R2 = R2 * 12
820 R2 = R2 * 100
830 R2 =  INT (R2)
840 R2 = R2 / 100
844  REM
845  REM FIND THE NEXT LARGER
846  REM EVEN LENGTH.
847  REM
850 R3 = R1
860  IF R3 <  > RL THEN R3 = R3 +
     1
870  IF R3 / 2 <  >  INT (R3 / 2)
      THEN R3 = R3 + 1
```

```
874  REM
875  REM FIND THE # NEEDED
876  REM
880 NR = (LP / SR + 1) * 2
884  REM
885  REM FIND THE COST
886  REM
890 CR = NR * R3 * C
892 CR =  INT ((CR * 100) + .5) /
     100
894  REM
895  REM FIND THE WASTE
896  REM
900 WR = NR * (R3 - RL)
901 WR =  INT ((WR / (R3 * NR)) *
     10000 + .5) / 100
910  REM
920  REM COMPUTE THE # OF JOIST
930  REM THEIR COST AND WASTE
940  REM
950  REM FIND THE # OF FEET
951  REM
960 J1 =  INT (LS)
964  REM
965  REM FIND THE # OF INCHES
966  REM
970 J2 = LS -  INT (LS)
980 J2 =  INT (J2 * 1200) / 100
984  REM
985  REM FIND THE NEXT LARGER
986  REM EVEN LENGTH.
987  REM
990 J3 = J1
1000  IF J3 <  > LS THEN J3 = J3 +
     1
1010  IF J3 / 2 <  >  INT (J3 / 2
     ) THEN J3 = J3 + 1
1014  REM
1015  REM FIND THE # NEEDED
1016  REM
1020 NJ = LP / SR + 1
1024  REM
1025  REM FIND THE COST
1026  REM
1030 CJ = NJ * J3 * C
1032 CJ =  INT ((CJ * 100) + .5) /
     100
1034  REM
1035  REM FIND THE WASTE
1036  REM
1040 WJ = NJ * (J3 - LS)
1041 WJ = (WJ / (J3 * NJ)) * 1000
     0
1042 WJ =  INT (WJ + .5) / 100
1050  REM
1060  REM COMPUTE THE LENGTH OF
1070  REM THE RIDGE BOARD AND
1080  REM THE FASCIAL BOARDS.
```

```
1081  REM
1082 LB = LP + (2 * OV)
1083  REM
1084  REM FIND THE # OF FEET
1085 B1 =  INT (LB)
1086  REM
1087  REM FIND THE # OF INCHES
1088 B2 = LB -  INT (LB)
1089 B2 =  INT ((B2 * 1200) + .5)
      / 100
1090  REM
1091  REM FIND THE NEXT LARGER
1092  REM EVEN LENGTH
1093  REM
1094 B3 = B1
1095  IF B3 <  > LB THEN B3 = B3 +
     1
1096  IF B3 / 2 <  >  INT (B3 / 2
     ) THEN B3 = B3 + 1
1097  REM
1098  REM COMPUTE THE COST
1099  REM
1100 CB = B3 * 3 * C
1101 CB =  INT (CB * 100 + .5) /
     100
1104  REM
1105  REM  COMPUTE THE WASTE
1106  REM
1107 WB = 3 * (B3 - LB)
1108 WB =  INT ((WB / (B3 * 3)) *
     1000 + .5) / 100
1109  REM
1110  REM COMPUTE THE NUMBER
1111  REM OF SQUARES.
1112  REM
1120 SQ = 2 * LB * (RL + (.5 * RT
     )) / 100
1125 SQ =  INT (SQ * 100 + .5) /
     100
1130  REM
1140  REM COMPUTE THE # OF
1150  REM PLYWOOD SHEETS NEEDED
1160  REM TO DECK THE ROOF.
1170  REM THEIR WASTE AND COST
1180  REM
1190  REM COMPUTE THE NEXT
1200  REM LARGER SIZE OF PLYWOOD
1210  REM FROM THE LENGTH OF THE
1220  REM RIDGEBOARD.
1230  REM
1240 P1 =  INT (LB / 4)
1250  IF P1 <  > LB / 4 THEN P1 =
     P1 + 1
1270  REM
1280  REM FIND VERTICAL SIZE
1290  REM
1300 P2 =  INT ((RL + (.5 * RT)) /
     2)
```

```
1310  IF P2 <  > (RL + (.5 * RT))
      / 2 THEN P2 = P2 + 1
1330  REM
1340  REM FIND THE # OF
1350  REM PLYWOOD SHEETS
1360  REM NEEDED TIMES 4
1365  REM BECAUSE PLYWOOD
1366  REM DIVIDED INTO 4TH'S
1367  REM IS STILL USEABLE.
1370  REM
1380 NP = P1 * P2 * 2
1381 NP =  INT (NP / 4)
1382  IF NP <  >  INT (P1 * P2 /
     2) THEN NP = NP + 1
1384  REM
1385  REM FIND THEIR WASTE
1386  REM
1390 WP = ((P1 * P2 * 2 * 8) - (S
     Q * 100)) / (P1 * P2 * 2 * 8
     )
1391 WP =  INT (WP * 10000 + .5) /
     100
1394  REM
1395  REM FIND THE COST OF
1396  REM THE PLYWOOD.
1400 PC = NP * CP
3050  REM
3060  REM OUTPUT RESULTS
3070  REM
3075  HOME : VTAB 6
3080  PRINT  TAB( 5)"DO YOU WANT
     THE OUTPUT TO GO"
3090  PRINT "TO THE PRINTER (Y/N)
     ?";: GET X$
3100  IF X$ = "Y" GOTO 3140
3110  IF X$ = "N" GOTO 3180
3120  PRINT : PRINT : PRINT : PRINT
      TAB( 5)"ILLEGAL ENTRY, TRY
     AGAIN.": PRINT : PRINT : PRINT

3130  GOTO 3080
3140  PRINT  TAB( 5)"SET THE PRIN
     TER TO THE TOP OF"
3142  PRINT "PRESS <RETURN> TO CO
     NTINUE";: INPUT A$
3150 D$ =  CHR$ (4)
3160  PRINT D$;"PR#1"
3170  PRINT : PRINT : PRINT
3180  IF X$ = "N" THEN  HOME : VTAB
     4
3190  HTAB 12: PRINT "CUTTING CHA
     RT": PRINT
3200  PRINT "ITEM";: HTAB 16: PRINT
     "QUANTITY";: HTAB 25: PRINT
     "LENGTH"
3210  PRINT "RAFTERS";: HTAB 16: PRINT
     NR;: HTAB 25: PRINT R1;" FT.
      ";R2;" IN."
```

```
3220  PRINT "JOIST";: HTAB 16: PRINT
     NJ;: HTAB 25: PRINT J1;" FT.
      ";J2;" IN."
3230  PRINT "RIDGEBOARDS";: HTAB
     16: PRINT "1";: HTAB 25: PRINT
     B1;" FT. ";B2;" IN."
3240  PRINT "FASCIAL BOARDS";: HTAB
     16: PRINT "2";: HTAB 25: PRINT
     B1;" FT. ";B2;" IN."
3250  PRINT "PLYWOOD SHEETS";: HTAB
     16: PRINT NP;: HTAB 25: PRINT
     "8 FT. BY 4 FT."
3260  PRINT : PRINT : PRINT
3270  HTAB 6: PRINT "MATERIAL AND
      COST CHART": PRINT
3280  PRINT "ITEM";: HTAB 16: PRINT
     "QUANTITY";: HTAB 25: PRINT
     "LENGTH";: HTAB 32: PRINT "C
     OST"
3290  PRINT "RAFTERS";: HTAB 16: PRINT
     NR;: HTAB 25: PRINT R3;" FT.
     ";: HTAB 32: PRINT "$";CR
3300  PRINT "JOIST";: HTAB 16: PRINT
     NJ;: HTAB 25: PRINT J3;" FT.
     ";: HTAB 32: PRINT "$";CJ
3310  PRINT "RIDGEBOARDS";: HTAB
     16: PRINT "1";: HTAB 25: PRINT
     B3;" FT.";: HTAB 32: PRINT "
     $"; INT (CB / 3 * 100 + 1) /
     100
3320  PRINT "FASCIAL BOARDS";: HTAB
     16: PRINT "2";: HTAB 25: PRINT
     B3;" FT.";: HTAB 32: PRINT "
     $"; INT (CB / 3 * 100) / 100
      * 2
3330  PRINT "PLYWOOD SHEETS";: HTAB
     16: PRINT NP;: HTAB 25: PRINT
     "4'X8'";: HTAB 32: PRINT "$"
     ;PC
3332 TC = CR + CJ + CB + PC
3335  PRINT : PRINT "TOTAL COST:
     ";TC
3340  IF X$ = "Y" THEN  PRINT  CHR$
     (12): PRINT  CHR$ (4);"PR#0"

3350  END

]
```

The final program in this group, and in this entire collection, is "CONCRETE". This program will estimate the cost and material needed to pour a concrete slab. For instance, suppose you had a slab 10' 0" by 15' 0", and 4" thick. Say this slab had #3 reinforcement bars(re-bars) that had a spacing of 16 inches. Also, let the slab have 4 concrete support beams. two that are 12" by 24" by 10' 0", with 4 #6 re-bars, and #3 strirrups 24" apart. The other two are 12" by 24" by 15" 0". They have 4 #6 re-bars and #3 strirrups that are 24" apart, and costing $0.43. The four beams are connected by four L-shaped conners. Further let's assume your slab has 4 peirs that have a 12" diameter and are 4' 6" long with bells. Also, the peirs have 2 #5 re-bars in them. Now let us consider the problem of estimating the cost if concrete cost $35.00 a yard, while #3 re-bars 20' long cost $8.25, #5's cost $9.75, and #6's cost $10.25. Given this information the program "CONCRETE" will give you an itemized list of materials needed and their cost, plus a total cost for all the material.

Now here is a sample run and listing of the program.

```
RUN CONCRETE


    THIS PROGRAM WILL HELP YOU FIGURE
THE COST, MATERIAL NEEDED, AND WASTE
OF A CONCRETE SLAB.


         DEMONSTRATION PROGRAM
        FOR EDUCATIONAL USE ONLY


    PRESS <RETURN> TO CONTINUE?



    TO RUN THIS PROGRAM YOU NEED TO
KNOW THE:
    DIMENSIONS OF THE SLAB.
    SIZE OF ALL REINFORCEMENT BARS.
    SPACING OF THE BARS WITHIN THE SLAB.
    DIMENSIONS OF ALL THE BEAMS.
    # OF RE-BARS TO GO IN EACH BEAM.
    SPACING & RE-BAR SIZE OF EACH
    STIRRUP.
    COST OF EACH STIRRUP.
    # OF L-SHAPED AND T-SHAPED CORNERS.
    DIMENSIONS OF ALL THE PEIRS.
    IF A GIVEN PEIR HAS A BELL.
    PRICE OF CONCRETE PER-YARD.
    PRICE OF 20FT OF RE-BAR FOR A
    A GIVEN SIZE, OR THE PRICE OF
    STEEL PER-POUND.


    DO YOU HAVE THIS INFORMATION (Y/N)?


    DIVIDE THE SLAB INTO RECTANGLES. HOW MANY RECTANGLE ARE THERE?1


    HOW LONG IS RECTANGLE 1 IN
FEET AND INCHES:
                  FEET?15
                  INCHES?0


    HOW WIDE IS RECTANGLE 1 IN
FEET AND INCHES:
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                    FEET?10
                    INCHES?0


          ENTER THE SLAB THICKNESS IN INCHES?4



           WHAT SIZE REINFORCEMENT BARS:

                     3 = SIZE #3
                     4 = SIZE #4
                     5 = SIZE #5
                     6 = SIZE #6
                     7 = SIZE #7
                     8 = SIZE #8



           WHAT IS THE SPACING BETWEEN THE BARS IN INCHES?16
           ENTER THE DIMENSIONS OF BEAM 1.

                THICKNESS IN INCHES?12
                DEPTH IN INCHES    ?24
                LENGTH IN FT & IN
                          FEET     ?10
                          INCHES   ?0



           ENTER THE QUANTITY & SIZE OF THE
         REINFORCEMENT BARS TO GO IN BEAM 1.

           QUANTITY?4


                        SIZE

                     3 = SIZE #3
                     4 = SIZE #4
                     5 = SIZE #5
                     6 = SIZE #6
                     7 = SIZE #7
                     8 = SIZE #8



           ENTER THE SPACING & REINFORCEMENT
         BAR SIZE OF THE STIRRUPS FOR BEAM 1.

           SPACING IN INCHES?24

                        SIZE
                     3 = SIZE #3
                     4 = SIZE #4
                     5 = SIZE #5
                    6 = SIZE #6
                    7 = SIZE #7
                    8 = SIZE #8


        IS THERE ANOTHER BEAM WITH THE
    SAME SPECIFICATIONS (Y/N)?
        HOW MANY?1



        IS THERE ANOTHER BEAM (Y/N)?    ENTER THE DIMENSIONS OF BEAM 2.

             THICKNESS IN INCHES?12
             DEPTH IN INCHES     ?24
             LENGTH IN FT & IN
                       FEET      ?15
                       INCHES    ?0


        ENTER THE QUANTITY & SIZE OF THE
    REINFORCEMENT BARS TO GO IN BEAM 2.

        QUANTITY?4


                      SIZE

                   3 = SIZE #3
                   4 = SIZE #4
                   5 = SIZE #5
                   6 = SIZE #6
                   7 = SIZE #7
                   8 = SIZE #8


        ENTER THE SPACING & REINFORCEMENT
    BAR SIZE OF THE STIRRUPS FOR BEAM 2.

        SPACING IN INCHES?24

                      SIZE
                   3 = SIZE #3
                   4 = SIZE #4
                   5 = SIZE #5
                   6 = SIZE #6
                   7 = SIZE #7
                   8 = SIZE #8

        IS THERE ANOTHER BEAM WITH THE
    SAME SPECIFICATIONS (Y/N)?
        HOW MANY?1
    IS THERE ANOTHER BEAM (Y/N)?


WHAT IS THE COST OF A STIRRUP 9 BY 21
INCHES MADE OF             #3 RE-BAR?0.43



    ENTER THE NUMBER OF L-SHAPED
CONERS?4

    ENTER THE NUMBER OF T-SHAPED
CONERS?0







    DO YOU HAVE ANY PEIRS Y = YES?



    ENTER THE DIMENSIONS OF PEIR 1.
              DIAMETER IN INCHES?12
              LENGTH IN FT & IN
                          FEET  ?4
                          INCHES?6



    DOES PEIR 1 HAVE A BELL (Y/N)?


ENTER THE QUANTITY AND SIZE OF THE
REINFORCEMENT BARS TO GO INTO THE PEIR
         QUANTITY: ?2
         SIZE #3-#8 ?

    ARE THERE OTHER PEIRS WITH THE SAME SPECIFICATIONS (Y/N)?
    HOW MANY?3



    IS THERE ANOTHER PEIR (Y/N)?


    WASTE IS USAULLY FIGURED BETWEEN
5 AND 10 %. WHAT PERCENT OF WASTE
DO YOU WANT TO FIGURE IN?6



    WHAT IS THE PRICE OF CONCRETE
PER-YARD.?3500
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    DO YOU WANT TO ENTER THE PRICE OF
STEAL IN POUNDS OR IN BARS (P/B)?B
WHAT IS THE COST OF A 20 FT #3 RE-BAR?8.25
WHAT IS THE COST OF A 20 FT #5 RE-BAR?9.75
WHAT IS THE COST OF A 20 FT #6 RE-BAR?10.25


    DO YOU WANT A HARDCOPY OF THE
OUTPUT (Y/N)?


    MAKE SURE THE PRINTER IS ON
AND SET THE PRINTER TO THE TOP OF THE
PAGE. THEN PRESS <RETURN>?


             CONCRETE

AMOUNT: 6.7 YARDS        COST: $23201

         REINFORCEMENT BARS

SIZE   QUANTITY          COST
 #3    9 BARS            $74.25
 #5    2 BARS            $19.5
 #6    11 BARS           $112.75

             STIRRUPS

RE-BAR SIZE        #     COST
 #3    9 X 21 IN   26    $11.18

              CORNERS
QUANTITY: 16             COST: $44

    TOTAL COST OF MATERIAL: $23462.88
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]LIST

10  REM THIS IS A PROGRAM
20  REM TO ESTIMATE THE COST
30  REM OF A CONCRETE SLAB.
40  REM
50  REM ENTER NEEDED DATA
60  REM
70  HOME : PRINT : PRINT : PRINT

75  DIM W(10),L(10),BC(6)
76  DIM RS(6),RC(6),RW(6)
77  DIM S(10),SS(10,3)
80  PRINT  TAB( 5)"THIS PROGRAM W
     ILL HELP YOU FIGURE"
90  PRINT "THE COST, MATERIAL NEE
    DED, AND WASTE"
100  PRINT "OF A CONCRETE SLAB."
101  PRINT : PRINT : PRINT
102  INVERSE
103  HTAB 10: PRINT "DEMONSTRATIO
     N PROGRAM"
104  HTAB 9: PRINT "FOR EDUCATION
     AL USE ONLY"
105  NORMAL
106  PRINT : PRINT : PRINT
107  PRINT  TAB( 5)"PRESS <RETURN
     > TO CONTINUE";: INPUT X$
108  HOME : PRINT : PRINT : PRINT

110  PRINT
120  PRINT  TAB( 5)"TO RUN THIS P
     ROGRAM YOU NEED TO"
130  PRINT "KNOW THE:"
131  PRINT  TAB( 5)"DIMENSIONS OF
      THE SLAB."
132  PRINT  TAB( 5)"SIZE OF ALL R
     EINFORCEMENT BARS."
133  PRINT  TAB( 5)"SPACING OF TH
     E BARS WITHIN THE SLAB."
134  PRINT  TAB( 5)"DIMENSIONS OF
      ALL THE BEAMS."
135  PRINT  TAB( 5)"# OF RE-BARS
     TO GO IN EACH BEAM."
136  PRINT  TAB( 5)"SPACING & RE-
     BAR SIZE OF EACH": PRINT  TAB(
     5)"STIRRUP."
137  PRINT  TAB( 5)"COST OF EACH
     STIRRUP."
138  PRINT  TAB( 5)"# OF L-SHAPED
      AND T-SHAPED CORNERS."
139  PRINT  TAB( 5)"DIMENSIONS OF
      ALL THE PEIRS."
140  PRINT  TAB( 5)"IF A GIVEN PE
     IR HAS A BELL."
141  PRINT  TAB( 5)"PRICE OF CONC
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     RETE PER-YARD."
142  PRINT  TAB( 5)"PRICE OF 20FT
      OF RE-BAR FOR A"
143  PRINT  TAB( 5)"A GIVEN SIZE,
      OR THE PRICE OF"
144  PRINT  TAB( 5)"STEEL PER-POU
     ND."
160  PRINT : PRINT : PRINT
170  PRINT  TAB( 5)"DO YOU HAVE T
     HIS INFORMATION (Y/N)?";: GET
     X$
180  IF X$ = "N" THEN  END
190  IF X$ <  > "Y" THEN  PRINT :
      PRINT : PRINT : GOTO 170
200  HOME : PRINT : PRINT : PRINT
     : PRINT : PRINT
205  REM ENTER # OF SLABS
210  PRINT  TAB( 5)"DIVIDE THE SL
     AB INTO RECTANGLES. HOW MANY
      RECTANGLE ARE THERE";: INPUT
     NR
215  REM ENTER SLAB DIMENSIONS
220  FOR I = 1 TO NR
230  PRINT : PRINT : PRINT
240  PRINT  TAB( 5)"HOW LONG IS R
     ECTANGLE ";I;" IN"
250  PRINT "FEET AND INCHES:"
260  PRINT  TAB( 20)"FEET";: INPUT
     F
270  PRINT  TAB( 20)"INCHES";: INPUT
     IN
280 IN = IN / 12
290 L(I) = F + IN
300  PRINT : PRINT : PRINT
310  PRINT  TAB( 5)"HOW WIDE IS R
     ECTANGLE ";I;" IN"
320  PRINT "FEET AND INCHES:"
330  PRINT  TAB( 20)"FEET";: INPUT
     F
340  PRINT  TAB( 20)"INCHES";: INPUT
     IN
350 IN = IN / 12
355 W(I) = F + IN
360  HOME
370  NEXT I
380  PRINT : PRINT : PRINT
390  PRINT  TAB( 3)"ENTER THE SLA
     B THICKNESS IN INCHES";: INPUT
     IN
392 IN = IN / 12
395 TS = IN
400  HOME : PRINT : PRINT : PRINT
     : PRINT
402  REM ENTER SIZE AND
403  REM SPACING OF REINFOCEMENT
404  REM BARS TO GO IN SLABS.
410  PRINT  TAB( 5)"WHAT SIZE REI
     NFORCEMENT BARS:"
```

```
420  PRINT
430  PRINT  TAB( 15)"3 = SIZE #3"

440  PRINT  TAB( 15)"4 = SIZE #4"

450  PRINT  TAB( 15)"5 = SIZE #5"

460  PRINT  TAB( 15)"6 = SIZE #6"

470  PRINT  TAB( 15)"7 = SIZE #7"

480  PRINT  TAB( 15)"8 = SIZE #8"

490  GET X
495  IF X < 3 OR X > 8 THEN 410
496 X = X - 2
560  PRINT : PRINT : PRINT : PRINT
      TAB( 5)"WHAT IS THE SPACING
      BETWEEN THE BARS IN INCHES"
     ;: INPUT SB
565 SB = SB / 12
566  REM
567  REM LOOP TO FIGURE
568  REM FEET OF BARS.
569  REM
570 NB = 0
580  FOR I = 1 TO NR
590 NB = NB + (((W(I) / SB) * (L(
     I) / SB)) * 2)
595 AC = AC + W(I) * L(I) * TS
600  NEXT I
610 RS(X) = NB
620 N = 1
630  HOME
635  REM ENTER BEAM DIMENSIONS
640  PRINT  TAB( 5)"ENTER THE DIM
     ENSIONS OF BEAM ";N;"."
650  PRINT
660  PRINT  TAB( 10)"THICKNESS IN
      INCHES";: INPUT TH
665 TH = TH / 12
670  PRINT  TAB( 10)"DEPTH IN INC
     HES    ";: INPUT D
675 D = D / 12
680  PRINT  TAB( 10)"LENGTH IN FT
      & IN  "
690  PRINT  TAB( 20)"FEET      ";:
      INPUT F
700  PRINT  TAB( 20)"INCHES    ";:
      INPUT IN
710 IN = IN / 12
720 F = F + IN
725 AC = AC + TH * D * F
780  HOME
790  PRINT : PRINT : PRINT
800  PRINT  TAB( 5)"ENTER THE QUA
     NTITY & SIZE OF THE"
810  PRINT "REINFORCEMENT BARS TO
```

```
     GO IN BEAM ";N;"."
820  PRINT
830  PRINT  TAB( 5)"QUANTITY";: INPUT
     Q
840  PRINT : PRINT
850  PRINT  TAB( 18)"SIZE"
860  PRINT
870  PRINT  TAB( 15)"3 = SIZE #3"

880  PRINT  TAB( 15)"4 = SIZE #4"

890  PRINT  TAB( 15)"5 = SIZE #5"

900  PRINT  TAB( 15)"6 = SIZE #6"

910  PRINT  TAB( 15)"7 = SIZE #7"

920  PRINT  TAB( 15)"8 = SIZE #8"

930  GET X
935  IF X < 3 OR X > 8 THEN 850
936 X = X - 2
940 RS(X) = RS(X) + Q * F
950  HOME : PRINT : PRINT : PRINT

960  PRINT  TAB( 5)"ENTER THE SPA
     CING & REINFORCEMENT"
970  PRINT "BAR SIZE OF THE STIRR
     UPS FOR BEAM ";N;"."
980  PRINT
990  PRINT  TAB( 5)"SPACING IN IN
     CHES";: INPUT IN
1000 IN = IN / 12
1010  PRINT
1020  PRINT  TAB( 18)"SIZE"
1030  PRINT  TAB( 15)"3 = SIZE #3
     "
1040  PRINT  TAB( 15)"4 = SIZE #4
     "
1050  PRINT  TAB( 15)"5 = SIZE #5
     "
1060  PRINT  TAB( 15)"6 = SIZE #6
     "
1070  PRINT  TAB( 15)"7 = SIZE #7
     "
1080  PRINT  TAB( 15)"8 = SIZE #8
     "
1090  GET Y
1095  IF Y < 3 OR Y > 8 GOTO 1010

1096 Y = Y - 2
1097 J = 1
1098  IF SS(J,1) = (TH * 12) - 3 AND
     SS(J,2) = (D * 12) - 3 AND S
     S(J,3) = Y THEN S(J) = S(J) +
      INT (F / IN + .5): GOTO 110
     0
1099  IF J <  > N THEN J = J + 1:
      GOTO 1098
1100  IF J = N THEN S(J) =  INT (
     F / IN + .5):SS(J,1) = (TH *
     12) - 3:SS(J,2) = (D * 12) -
     3:SS(J,3) = Y
1101  PRINT : PRINT
1102  PRINT  TAB( 5)"IS THERE ANO
     THER BEAM WITH THE"
1103  PRINT "SAME SPECIFICATIONS
     (Y/N)?": GET A$
1104  IF A$ = "N" GOTO 1110
1105  PRINT  TAB( 5)"HOW MANY";: INPUT
     K
1106  FOR I = 1 TO K:AC = AC + TH
      * D * F:RS(X) = RS(X) + Q *
     F:S(J) = S(J) +  INT (F / IN
      + .5): NEXT I
1110  PRINT : PRINT : PRINT : PRINT

1120  PRINT  TAB( 5)"IS THERE ANO
     THER BEAM (Y/N)?";: GET X$
1130  HOME
1140  IF X$ = "Y" THEN N = N + 1:
      GOTO 640
1149  PRINT : PRINT : PRINT
1150  FOR I = 1 TO 10
1151  IF S(I) = 0 GOTO 1159
1152  PRINT "WHAT IS THE COST OF
     A STIRRUP ";SS(I,1);" BY ";S
     S(I,2): PRINT "INCHES MADE O
     F                #";SS(I,3) + 2
     ;" RE-BAR";: INPUT K
1153 SC(I) =  INT (K * S(I) * 100
      + .5) / 100
1159  NEXT I
1160  HOME : PRINT : PRINT : PRINT

1161  REM
1162  REM ***CORNERS***
1163  REM
1165  PRINT  TAB( 5)"ENTER THE NU
     MBER OF L-SHAPED"
1170  PRINT "CONERS";: INPUT C
1180  PRINT : PRINT  TAB( 5)"ENTE
     R THE NUMBER OF T-SHAPED"
1190  PRINT "CONERS";: INPUT TC
1200 C = C + TC
1210 C = C * 4
1220  HOME : PRINT : PRINT : PRINT

1222  REM
1223  REM ***PEIRS***
1224  REM
1225 N = 1
1226  PRINT : PRINT : PRINT
1227  PRINT  TAB( 5)"DO YOU HAVE
     ANY PEIRS Y = YES?": GET X$
1228  PRINT : PRINT : PRINT
```

```
1229  IF X$ <  > "Y" GOTO 1330
1230  PRINT  TAB( 5)"ENTER THE DI
     MENSIONS OF PEIR ";N;"."
1240  PRINT  TAB( 15)"DIAMETER IN
      INCHES";: INPUT DI
1241 DI = DI / 12
1250  PRINT  TAB( 15)"LENGTH IN F
     T & IN"
1251  PRINT  TAB( 27)"FEET  ";: INPUT
     F
1252  PRINT  TAB( 27)"INCHES";: INPUT
     IN
1253 F = F + (IN / 12)
1254 P = P + (((DI / 2) ^ 2) * 3.
     1416 * F)
1260  PRINT : PRINT : PRINT
1270  PRINT  TAB( 5)"DOES PEIR ";
     N;" HAVE A BELL (Y/N)?";: GET
     X$
1275 LP = 1.5 * DI
1280  IF X$ = "Y" THEN BE = BE +
     (((DI / 2) ^ 2) * 3.1416 * L
     P)
1290  PRINT : PRINT : PRINT
1291  PRINT "ENTER THE QUANTITY A
     ND SIZE OF THE": PRINT "REIN
     FORCEMENT BARS TO GO INTO TH
     E PEIR"
1292  PRINT  TAB( 10)"QUANTITY: "
     ;: INPUT Q
1293  PRINT  TAB( 10)"SIZE #3-#8
     ?";: GET X
1294 X = X - 2
1295 RS(X) = RS(X) + Q * F
1296  PRINT : PRINT : PRINT  TAB(
     5)"ARE THERE OTHER PEIRS WIT
     H THE SAME SPECIFICATIONS (Y
     /N)?": GET A$
1297  IF A$ = "N" GOTO 1300
1298  PRINT  TAB( 5)"HOW MANY";: INPUT
     Y: FOR I = 1 TO Y:P = P + ((
     (DI / 2) ^ 2) * 3.1416 * F):
      IF X$ = "Y" THEN BE = BE +
     (((DI / 2) ^ 2) * 3.1416 * L
     P):RS(X) = RS(X) + Q * F
1299  NEXT I
1300  PRINT : PRINT : PRINT
1305  PRINT  TAB( 5)"IS THERE ANO
     THER PEIR (Y/N)?";: GET X$
1310  HOME : PRINT : PRINT : PRINT

1320  IF X$ = "Y" THEN N = N + 1:
      GOTO 1230
1321 P = P + BE
1330  PRINT  TAB( 5)"WASTE IS USA
     ULLY FIGURED BETWEEN"
1340  PRINT "5 AND 10 %. WHAT PER
     CENT OF WASTE"
```

```
1350  PRINT "DO YOU WANT TO FIGUR
     E IN";: INPUT WA
1351 WA = WA / 100
1360  HOME : PRINT : PRINT : PRINT

1370  PRINT  TAB( 5)"WHAT IS THE
     PRICE OF CONCRETE"
1380  PRINT "PER-YARD.";: INPUT C
     P
1381  HOME : PRINT : PRINT : PRINT

1382  PRINT  TAB( 5)"DO YOU WANT
     TO ENTER THE PRICE OF"
1383  PRINT "STEAL IN POUNDS OR I
     N BARS (P/B)";: INPUT J$
1384  IF J$ = "P" GOTO 1399
1385  IF J$ <  > "B" GOTO 1381
1386  FOR I = 1 TO 6
1387  IF RS(I) <  > 0 THEN  PRINT
     "WHAT IS THE COST OF A 20 FT
      #";I + 2;" RE-BAR";: INPUT
     BC(I)
1388  NEXT I
1389  GOTO 1420
1399  PRINT : PRINT : PRINT
1400  PRINT  TAB( 5)"WHAT IS THE
     PRICE OF STEEL "
1410  PRINT "PER-POUND";: INPUT C
     S
1420  HOME : PRINT : PRINT : PRINT

1430  REM
1440  REM COMPUTE MATERIAL
1450  REM AND COST
1460  REM
1470  REM COMPUTE CONCRETE
1520 AC = AC + P
1530 AC = AC / 27
1531 CW = AC * WA
1532 AC = AC + CW
1540 CT = AC * CP
1545 AC =  INT (AC * 10 + 1) / 10

1546 CT =  INT (CT * 100 + .5) /
     100
1550  REM
1560  REM COMPUTE RE-BARS
1570  REM
1571  REM SET RE-BAR WEIGHT
1572 RP(1) = .376
1573 RP(2) = .668
1574 RP(3) = 1.043
1575 RP(4) = 1.502
1576 RP(5) = 2.044
1577 RP(6) = 2.67
1580  FOR X = 1 TO 6
1582 RW(X) = RS(X) * WA
1584 RS(X) = RS(X) + RW(X)
```

```
1585  IF RS(X) / 20 =  INT (RS(X)
      / 20) THEN K =  INT (RS(X) /
     20)
1586  IF RS(X) / 20 <  >  INT (RS
     (X) / 20) THEN K =  INT (RS(
     X) / 20) + 1
1587 RS(X) = K
1590  IF J$ = "P" THEN RC(X) = RS
     (X) * RP(X) * CS * 20
1595  IF J$ = "B" THEN RC(X) = RS
     (X) * BC(X)
1600  NEXT X
1800  REM
1801  PRINT  TAB( 5)"DO YOU WANT
     A HARDCOPY OF THE"
1802  PRINT "OUTPUT (Y/N)?": GET
     X$
1803  IF X$ <  > "Y" GOTO 1809
1804  PRINT : PRINT : PRINT  TAB(
     5)"MAKE SURE THE PRINTER IS
     ON"
1805  PRINT "AND SET THE PRINTER
     TO THE TOP OF THE"
1806  PRINT "PAGE. THEN PRESS <RE
     TURN>";: INPUT A$
1808  PRINT  CHR$ (4);"PR#1"
1809  HOME : PRINT : PRINT : PRINT

1810  REM OUTPUT CHART
1820  REM
1830  PRINT  TAB( 16)"CONCRETE"
1840  PRINT
1850  PRINT "AMOUNT: ";AC;" YARDS
     ";: HTAB 25: PRINT "COST: $"
     ;CT
1860  PRINT
1870  PRINT  TAB( 8)"REINFORCEMEN
     T BARS"
1872  PRINT
1873  PRINT "SIZE";: HTAB 8: PRINT
     "QUANTITY";: HTAB 25: PRINT
     "COST"
1880  FOR X = 1 TO 6
1885  IF RS(X) <  > 0 THEN  PRINT
     " #";X + 2;: HTAB 8: PRINT R
     S(X);" BARS";: HTAB 25: PRINT
     "$"; INT (RC(X) * 100 + .5) /
     100
1890  NEXT X
1895  PRINT
1900  PRINT  TAB( 16)"STIRRUPS"
1910  PRINT
1920  PRINT "RE-BAR";: HTAB 8: PRINT
     "SIZE";: HTAB 20: PRINT "#";
     : HTAB 25: PRINT "COST"
1940  FOR I = 1 TO 10
1950  IF S(I) = 0 GOTO 1970
1960  PRINT " #";SS(I,3) + 2;: HTAB
```

```
     8: PRINT SS(I,1);" X ";SS(I,
     2);" IN";: HTAB 20: PRINT S(
     I);: HTAB 25: PRINT "$"SC(I)

1970  NEXT I
1980  PRINT
1990  PRINT  TAB( 17)"CORNERS"
2000  PRINT "QUANTITY: ";C;: HTAB
     25: PRINT "COST: $"; INT (C *
     100 * 2.75 + .5) / 100
2020 T = CT
2030  FOR I = 1 TO 6
2040 T = T + RC(I)
2050  NEXT I
2060  FOR I = 1 TO 10
2070 T = T + SC(I)
2080  NEXT I
2090 T = T + C * 2.75
2100 T =  INT (T * 100 + 1) / 100

2110  PRINT : PRINT  TAB( 5)"TOTA
     L COST OF MATERIAL: $";T
2120  IF X$ = "Y" THEN  PRINT  CHR$
     (12): PRINT  CHR$ (4);"PR#0"

2130  END

]
```

```
10 '       THIS IS A PROGRAM FOR THE STUDENT OF CARPENTRY,
20 ' ESTIMATING, AND ARCHITECTURAL DRAFTING. IT WOULD BE
30 ' PREFERABLE IF THE STUDENT HAD KNOWLEADGE OF THE TERMS
40 ' RISE, RUN, SPAN, RIDGEBOARD, OVERHANG, AND RAFTER AS
50 ' THEY PRETAIN TO ROOF FRAMING.
60 '
70 ' THIS PROGRAM IS USED TO COMPUTE THE LENGTH OF A COMMAN
80 ' RAFTER ON A BUILDING. IT WILL BE NECESSARY TO KNOW OR
90 ' HAVE ON HAND THE SPAN DIMENSION PER FOOT OF RUN, THE
100 ' ROOF OVERHANG LENGTH, AND THE RIDGEBOARD THICKNESS
110 ' IF THERE IS A RIDGEBOARD.
260 '
270 '
280 T2=2
290 T2=0
300 '
310 '
320 '       FIGURE THE LENGTH OF THE COMMAN RAFTER.
330 '
340 '
360 PRINTTAB(5)"TO USE THIS PROGRAM YOU WILL NEED TO HAVE THE"
370 PRINT"FOLLOWING DATA.":PRINT
380 PRINTTAB(5)"RAFTER SLOPE, RUN(1/2 SPAN), OVERHANG, THICKNESS"
390 PRINT"OF THE RIDGEBOARD.":PRINT
400 PRINTTAB(5)"IF YOU NEED THESE FIGURES PRESS THE <BREAK> KEY"
410 PRINT"AND OBTAIN THEM."
420 PRINT
430 PRINTTAB(5)"FIRST TYPE IN YOUR RISE FOR ONE FOOT OF RUN."
440 PRINT"IN INCHES";:INPUT A
450 PRINT:PRINT:PRINT
460 '
470 '       A   IS EQUAL TO THE ALTITUDE OR RISE OF THE SLOPE.
480 '
490 '       H   IS EQUAL TO THE HYPOTENUSE OF THE SLOPE.
500 '
510 '       L   THE LENGTH OF THE RUN.
520 '
550 H=(A[2)+144
560 PRINTTAB(5)"WHAT IS THE RUN (1/2 SPAN), IN FEET AND INCHES."
570 PRINTTAB(10)"FEET: ";:INPUT R1
580 PRINTTAB(10)"INCHES: ";:INPUT R3
590 R3=R3/12
600 R1=R1+R3
610 PRINT:PRINT:PRINT
620 '
630 ' L1    THE RAFTER LENGTH.
640 '
650 L1=(SQR (H))*R1
660 PRINTTAB(5)"IS THERE AN OVERHANG? (Y/N)";
665 A$=""
670 A$=INKEY$:IF A$="" THEN 670
680 PRINT:PRINT:PRINT
690 IF A$ = "Y" THEN 730
700 IF A$ = "N" THEN 740
```

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```
710 PRINTTAB(5)"ILLEAGLE ENTRY, PLEASE TRY AGAIN.":PRINT:PRINT:PRINT
720 GOTO 660
730 GOSUB 930
740 PRINTTAB(5)"IS THERE A RIDGEBOARD? (Y/N)";:B$=""
750 B$=INKEY$:IF B$="" THEN 750
760 PRINT:PRINT:PRINT
770 IF B$ = "Y" THEN 810
780 IF B$ = "N" THEN 820
790 PRINTTAB(5)"ILLEAGLE ENTRY, PLEASE TRY AGAIN.":PRINT:PRINT:PRINT
800 GOTO740
810 GOSUB 1000
820 L3=L1+L2-T2
830 L3=L3/12
840 PRINTTAB(5)"THE LENGTH OF THE RAFTER WILL BE ";INT(L3);" FEET"
850 PRINT"AND ";(L3-INT(L3))*12;" INCHES.":PRINT:PRINT:PRINT
860 PRINTTAB(5)"ARE THERE ANY MORE RAFTERS TO BE COMPUTED? (Y/N)";
865 C$=""
870 C$=INKEY$:IF C$="" THEN 870
875 PRINT:PRINT:PRINT
880 IF C$="Y" THEN 430
890 IF C$="N" THEN 920
900 PRINTTAB(5)"ILLEAGLE ENTRY, PLEASE TRY AGAIN.":PRINT:PRINT:PRINT
910 GOTO 860
920 END
930 PRINTTAB(5)"GIVE THE OVERHANG DIMENSIONS IN FEET AND INCHES."
940 PRINTTAB(10)"FEET: ";:INPUT O
950 PRINTTAB(10)"INCHES: ";:INPUT O3
955 O3=O3/12
960 O=O+O3
970 PRINT:PRINT:PRINT
980 L2=O*(SQR(H))
990 RETURN
1000 PRINTTAB(5)"GIVE THE THICKNESS OF THE RIDGEBOARD IN INCHES:
     ";:INPUT T
1010 T=T/12
1020 T2=T/12
1030 RETURN
```